Electrical World

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An Evidence of Good Will

REPUBLICS are not ungrateful. The authorities of West Seneca, N. Y., have just demonstrated this fact by willingly waiving their rights and accepting a 30 per cent increase in rates in order that the utility supplying the town may live. The utility proved to the regulatory body that it had not been able to do a satisfactory or profitable business for some years owing to the rate fixed by its franchise. Recognizing that they had a mutual interest in the business and that good service by the utility should be properly compensated in order to make the business remunerative, because only a successful company can render proper and efficient service, the community assented to an increase. What an ideal community West Seneca must be, and what also must be the reputation of the utility! For to every action there must be an opposite and equal reaction. The utility must have deserved the good will of the community or the latter would have insisted on its legal rights.

The Nobel Prize

ANNOUNCEMENT of the award of the Nobel prize in physics to Edison and Tesla will give great satisfaction to the engineering profession in our country, to which both have contributed distinguished services. It is gratifying also to realize that, aside from pioneer work in engineering, both have done notable work in the advance of science. The name of Thomas Alva Edison has been long associated with the invention and development of the incandescent electric lamp. When he brought his inventive genius to bear on the incandescent-lamp problem results followed which have built up an enormous industry. His indefatigable persistence won where all others had failed, and not only did he solve the fundamental problem of the lamp but he turned out almost simultaneously a complete system for its practical utilization. But Mr. Edison would still rank as one of the very greatest inventors of modern times if someone else had done this splendid work and his reputation had to rest solely on other achievements. His well-known labors in purely telegraphic matters were triumphs of ingenuity, but yet more striking and original was his now almost forgotten invention of the electrolytic relay, which is reputed to have won for him one of the largest payments ever made for a patent. Later his ingenuity was lent to develop the telephone transmitter, and at about the same time came the beginnings of the phonograph, by all means his most brilliant contribution to physics. And later yet have come his contributions to art and science in the invention and development of motion pictures. There is no space here to recite the long list of what Edison has accomplished, but the Nobel foundation honors itself in appreciating what he has done for science, to say nothing of his prodigious activity in the industrial arts.

To Nikola Tesla the world owes that great impulse which has resulted in the whole modern art and science of power transmission. The use of alternating current for practical electrical distribution began with his development of the induction motor, which at once gave the general flexibility and usefulness of the system its due place in the practical world. With that invention the struggle between direct and alternating currents presently ceased, and each fell into its proper sphere of usefulness, of which the boundaries are still expanding. The development of the art was rapid, for the seed that Tesla sowed fell upon good ground. Those who followed the development of the art in its earlier years remember to their sorrow the number of times they found their earnest efforts at improvement just a lap or two behind Tesla's inventive genius in the running. His later pioneering work in the development of high-frequency currents in theory and practice displayed brilliant resourcefulness. In wireless telegraphy, on which he spent a long period of tireless research, inventors of the present and future will find themselves often confronted with the results of his inventive energy and keen scientific insight. His grasp of alternating-current phenomena has left the indelible mark of his originality on the progress of the electrical arts, and his participation in the Nobel prize is a proper and worthy appreciation of his genius. Those who remember Tesla's lecture before the Institute of Electrical Engineers on high-frequency phenomena, now nearly a quarter of a century ago, realize the extent to which his investigations opened the way to a field of which we have not even yet seen the full fruition. The country may well be proud of the recognition given in this award to men who thus have been in the front rank of its victorious march in applied science.

A Motto for Public Relations

A BUSINESS philosopher writes in the *Atlantic Monthly:* "Until the facts are in the right order there is no truth." *Collier's Weekly* quotes this phrase as a motto for writers. We present it as a text for all those engaged in the problems of public relations. More facts are needed to answer fairly the intimate questions affecting the regulation of public utilities. But facts alone may be most misleading unless interpreted in the right order.

Single-Phase Suburban Service Out of Philadelphia

ELECTRIFICATION of suburban service out of Philadelphia on the Pennsylvania Railroad, outlined elsewhere in this issue, furnishes another instance in which single-phase operation has been adopted for main-line requirements. In choosing the system that would best handle service conditions the engineers attached special importance to future long-distance operation over several different divisions handling different classes of service rather than to the present requirements of the short-line service, which includes the use of about 90 miles of track. From an engineering consideration of all the conditions in this particular case analysis indicated that single-phase operation would prove economical in first cost and in operating cost, with a sufficient saving in costs above steam-operating costs to pay interest on the investment required.

One of the contributing conditions to economical operation was the elimination of a large investment in generating equipment made possible by purchase of energy from the local central-station company. This practice contrasts with that adopted for the operation of the single-phase electrification of the mountain districts of the Norfolk & Western Railway designed by the same engineers. In the latter case a good load factor and cheap coal made the installation of a steam generating station attractive.

The diversity factor is such as to make the sale of power advantageous to the central station. It also serves as another example of the use of purchased service where benefits are directly shown in the reduction of the initial investment. The use of attendantless, step-down substations under the control of tower men who are in touch with a central power director by telephone has contributed to the reduction of operating expense. The present service to these substations is taken from one phase of the central-station company's three-phase system. It is planned to supply demands of future electrification from the other two phases. The details of protection and control of the single-phase lines have worked out to a nicety. Especially interesting also is the equipment of standard suburban steel coaches, in that use is made of the series-repulsion motor, so popular in Europe but never thus far widely employed in the United States.

Precipitating Soot Electrically

ELECTRICAL methods to prevent chimneys smoking may sometimes be improved and used as a practical way not only of preventing the smoke but also of recovering that part of the fuel which it represents. Electrical precipitation, lately suggested in several quarters, is being used successfully in smelter plants, powder factories and cement mills for the deposition of fumes and dust, and there seem to be good reasons for its consideration in some power plants using bituminous coal high in volatile matter. An important consideration for the practicability of this process of smoke prevention lies in getting rid of the precipitated masses. It is difficult to design an apparatus that acts continuously, but this must be accomplished if the process is to be capable of commercial use. A receptacle which is low enough, large enough and yet out of the way enough not to interfere seriously with the draft is necessary. The character of this receptacle must be adapted to the particular stack to which the process is applied. Many objections have been raised to applying this process to smokestacks, the contention being that more efficient firing should be encouraged. This is evidently true, and although this process does not save the heat units lost in the gases, its application would do much toward lessening the smoke evil in our large cities.

First Aid to Asphyxiated Steam Plants

IN winter when the door of a boiler room is opened there is an inward rush of air that is not always noticeable in summer; in summer there are large air passages open which are entirely or partly closed during cold weather, and yet the condition suggests an operation problem of importance. In boiler rooms a greater quantity of air is required in winter than in summer because the loads are heavier and hence more fuel is consumed. If, therefore, in stations using either natural or induced draft the air passages are closed completely, a serious effect on the capacity of the equipment may, and often does, result. The coal will burn slowly, combustion will be incomplete, and ash and clinker troubles will be added. The supply of air in extreme cases may be reduced to such a point that the continual demand for it due to operating conditions will create a difference in pressure between the inside and the outside of the boiler room with an effect on draft equivalent to partly closing the ash pit of the dampers. An instance of a station containing fifteen boilers in operation with ten more held for service during winter peaks may be cited. The boilers each consumed about 3000 lb. of coal per hour, requiring about 300,000 cu. ft. of air per minute from the boiler room. In winter trouble was experienced with the fires during the night peak because the windows were closed. When sufficient inlets for air were provided, however, the trouble disappeared.

Setting the Clock of the Nation's Housewives

THERE is good news for the lonely mariner in the announcement that the government radio station at Washington will shortly begin sending regular time signals for the benefit of ships along the coast. But the horological needs of those who sail the seas are hardly comparable, after all, with the dire isolation—so far as accurate time o' day is concerned—of the average American household, with its Connecticut clock set by guess or by the noon whistles and seldom telling within fifteen minutes of the mean solar truth. To furnish accurate time to the households of the nation, then, offers an opportunity for public service worthy of the ambition of any utility management. Several plans at once suggest themselves for the use of the wires of

utility companies entering these dwellings. Signals might be prearranged by momentary interruptions of the lighting circuits, as has been successfully carried out in several Western cities for announcing elections and other events of local interest. A better plan would be the addition to every household telephone of a remote-controlled clock which would be set hourly by impulses from the central office. It would be no great technical problem to arrange circuits which would not interfere with the primary function of the telephone line and yet would also fulfill this function.

How Far to Trust

BUSINESS credit in general is established on the assumption that men pay what they owe. Retail businesses are conducted on the basis that the customer is honest until he has proved otherwise. In the retailing of electrical energy, on the other hand, the penalizing methods of collecting in some instances suggest that all customers are rascals until proved honest.

The question is not that of deciding whether a collection method shall be lax or tight. Money is due for service rendered and should be collected promptly, but the spirit behind the collection method should not be a force for ill will and misunderstanding. Every customer appreciates the fact that the sale of electrical energy is a business. Everybody realizes that bills must be collected. There is a point, however, where the manager should balance the comparative value of the future business which a customer promises and the importance of his quick-collection routine, asking himself which he can best afford to humor a bit. Undoubtedly the public can be educated to the habit of prompt and regular payment of electric-light bills, and a record for good collections is an object worthy of the ambition of any manager, for he controls the company's funds in trust and should not see them dissipated. There is such a thing as being over-zealous in the prosecution of a hobby, however, even to the extent of ignoring simple, common courtesy. The collection policy touches closely the establishment of good will and should be determined on that broad basis.

A Clearing House for Positions

A RECENTLY organized group of young engineers in Chicago, the American Association of Engineers, deserves especial credit for the impulse it is giving to the formation of a clearing house for engineering positions. Engineering ability in the past has been marketed largely on the same basis as day labor. There ought to be some agency, broad in scope, to put competent engineers and opportunities in touch. There are difficulties in the way of such a plan. Engineers are by nature conservative, and, as one puts it, "Undue publicity will attract the dissatisfied and repel others." The Western Society of Engineers is also investigating the possibilities of such a bureau. Co-operation between the two bodies ought to result in finding the right solution for the problem.

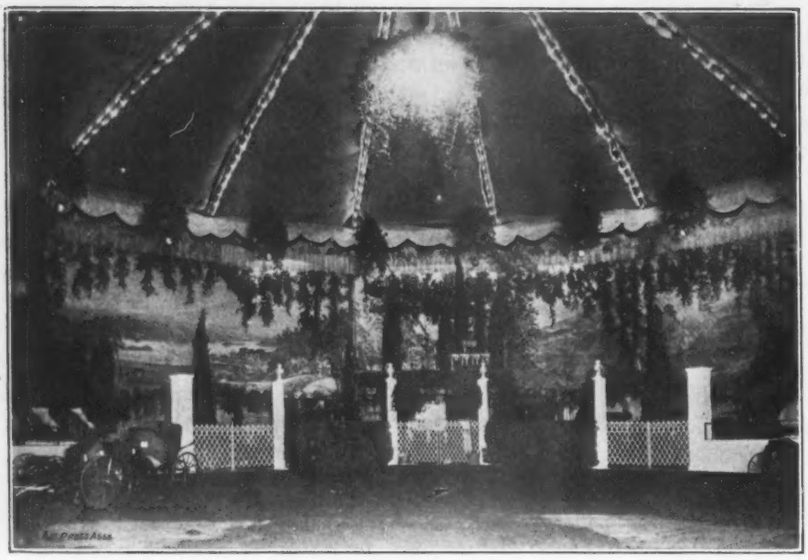
By-Product for the Contractor

SOME of our most profitable industries to-day are based entirely on the utilization of the by-product that has been thrown off in the process of some other manufacturing activity. It typifies the length to which our modern spirit of efficiency can be developed. There is a natural tendency, however, to look upon it as a principle primarily affecting large endeavors and to forget entirely that the daily incidental opportunities that come to all of us are, after all, our by-products and should not be thrown away. The work of the electrical contractor, in particular, is rich in these by-product opportunities. Every home or store or factory that he enters presents, if his eye is watchful, a market for small items of equipment that can be sold to profit while he is on the spot, if he but has a mind to do so. In every home there are appliances that can be recommended or points where another baseboard outlet will bring greater comfort, or current taps or other improved attachment devices can be suggested and sold. Almost everywhere the right-size lamp, or better shades, or proper placement of the lights, is needed. These are by-product opportunities for every contractor. They pay well for the little time and thought that serve to turn them into cash.

Firebrick for Boiler Furnaces

MORE than 30 per cent of the entire cost of boiler and furnace maintenance is due to repairs to brickwork, states a writer elsewhere in this issue. It is evident that the selection of firebrick is an engineering consideration that demands more attention than it now gets in most plants, not only in large modern steam-electric stations but in the average hand-fired plant as well. Arch and furnace linings are subjected to much more severe conditions in modern boiler practice than in years gone by. Brick heretofore suitable may now be most expensive. Higher furnace temperatures are largely responsible for the changed conditions. The reduction of the air supplied to the furnace, bringing the quantity closer to that required for perfect combustion only, has had the effect of raising the temperature of the resulting products of combustion. Furthermore, the rate of combustion per square foot of grate surface has been increased of late years so that modern boiler installations are frequently operated at 200 per cent overload as compared with older installations that were operated at normal rating or under only slight overloads. Thus, while earlier practice produced furnace temperatures of from 1800 deg. to 2400 deg. Fahr., modern practice has raised these values to from 2500 deg. to 3000 deg. Fahr. To withstand the increased temperature successfully and continuously, not only must the qualities of the refractory materials used for furnace arches, linings and side walls be of a higher standard of excellence, but also the workmanship displayed in putting up the brickwork, as well as the joint-making materials, must be of a correspondingly high grade.

Electricity at the New York Horse Show in Madison Square Garden



After a summer spent as a motion-picture showhouse, historic Madison Square Garden, New York City, came back into its own during the present week and once more served as the setting for the annual Horse Show, New York's brilliant yearly spectacle of wealth, fashion and fine horseflesh. Although the automobile and other influences have admittedly made serious inroads on the number of devotees of the horse, as evidenced by the reduced attendance at the Garden this year, the arrangements for the 1915 Horse Show were particularly complete. Electricity played a conspicuous part in the artistic decorations which provided the background for the arena. Hidden light sources illuminated the special scenic drops, the central statue and the electric fountains, and a swarm of electric fireflies glittered among the branches of the forest trees which flanked the boxes. A huge sunburst of 284 40-watt tungsten lamps lighted the center of the arena, and about this was ranged a circle of 56 1000-watt nitrogen-filled lamps which will be made a permanent part of the Garden lighting, replacing the girder border lamps. The entrance-way, with the aid of mirrors, electric-lighted Japanese lanterns and "moonlight" blue lamps above the leaf-covered arbor, simulated the setting for an evening lawn party. An electric score board at the ringside announced the award of blue ribbons to the equine victors by the judges.

A Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

ELECTRIC POWER CLUB MEETS

Motor Manufacturers Effect Changes in Commercial Ratings of Generators and Motors to Make Them Comply with A. I. E. E. Rules

What was considered one of the best meetings ever held by the Electric Power Club took place at the Homestead Hotel, Hot Springs, Va., on Nov. 8, 9 and 10 and was attended by forty-seven members, representing twenty companies.

The constitution of the club was amended so as to include as members manufacturers of transformers and industrial control apparatus, thereby opening up a very large field for standardization which it is expected will prove as valuable to both the manufacturers and users as the standardization work already done on electric motors and generators. Five companies manufacturing this class of apparatus were elected to membership, making a present membership of forty-four companies in the electrical industry.

In the work of standardization of motors and generators a number of changes in the existing commercial ratings were made to bring them within the limits established by the new rules of the American Institute of Electrical Engineers. The allowable variation in voltage at which motors will operate successfully was fixed at 10 per cent above or below the rated voltage. It was recognized, however, that such a variation did not necessarily mean that the motor would operate within the guarantees given for operation at normal voltage. The starting torque for continuous-duty polyphase induction motors with full voltage applied was standardized as not less than 150 per cent of full-load torque for two-pole, four-pole and six-pole motors, 125 per cent for eight-pole, ten-pole and twelve-pole motors, and 100 per cent for fourteen-pole motors. The maximum torque for such machine shall not be less than 200 per cent of full-load torque. For direct-current motors the variation in speed from full load cold to full load hot was fixed as not to exceed 10 per cent based on the full speed hot.

There was considerable discussion on the proper basis of rating for continuous-duty motors and generators used for general purposes as distinguished from special-application machines used where the conditions of service and magnitude of load are definitely fixed and known beyond question. An illustration of a special-application machine is a motor directly connected to a blower where the maximum load is definitely known and cannot be exceeded. The sentiment expressed at the meeting indicated that for general-purpose machines the Electric Power Club was decidedly in favor of making no change in the present basis of rating, namely 40 deg. C. at full rated load with a 25 per cent overload temperature guarantee for two hours, but that in the case of special-application machines a higher temperature rise, but still within the limits established by the American Institute of Electrical Engineers and with no overload temperature guarantee, might be easily susceptible of justification.

Edison and Tesla Win Nobel Prize

Under date of Nov. 6, the Copenhagen correspondent of the London *Daily Telegraph* sends the following:

"The Swedish government has decided to distribute the Nobel prizes next week as follows:

"Physics, Thomas A. Edison and Nikola Tesla; literature, Romain Rolland (French), Hendrik Pontoppidan and Troels Lund (Danes), and Verner von Heidenstam (Swede); chemistry, Prof. Theodor Sveberg."

No confirmation of the story could be obtained, and neither Mr. Edison nor Mr. Tesla has received any intimation of the award except through the daily press account.

PUBLIC RATE HEARING IN NEBRASKA

President Harries of Omaha Company Welcomes Participation of Public in Determining Fair Rates

General George H. Harries, president of the Omaha Electric Light & Power Company and past-president of the Association of Edison Illuminating Companies and of the American Electric Railway Association, who has stanchly supported and widely advocated a fostering of relationship between public and public utilities to such a degree as to make that relation virtually a partnership, is now fathering a most practical application of these principles in Omaha. The situation there is novel and most interesting, and is briefly as follows:

An active agitation for a municipally owned lighting plant prevalent for some time back terminated in the passing of a bill at the last session of the State Legislature which provided for such a plant to compete with the present Omaha company. This measure, however, was vetoed by the Governor. Since this legislation the company voluntarily reduced its rate from the two-rate system based on assumed demand of 11 cents for the first thirty hours and 6 cents for excess over this, with a 5 per cent discount on the gross bill, to a block-rate system as follows: 8 cents for the first 25 kw.-hr., 6 cents for the next 125 kw.-hr., 5 cents for the next 1050 kw.-hr., 4 cents for the next 2800 kw.-hr., 3 cents for the next 3000 kw.-hr., 2½ cents for all over that, and a minimum charge of 50 cents.

This the company claimed to be an absolutely fair rate, and it welcomed any honest investigation to establish it as such in the eyes of the public. General Harries invited the Commercial Club of Omaha to inaugurate an investigation. Accordingly a committee of ten, with a personnel comprising eight leading business men and two lawyers, was appointed from the club membership. A recommendation to the City Council by this committee that the company and the city bear the expense of the investigation jointly was rejected. Later General Harries urged the committee to select reputable auditors, the company to bear the entire expense and give the auditors access to all its books, vouchers and everything from the beginning of its operations twenty-five years ago. This was done, and the auditors are now at work to determine the cash value of the present property as a basis upon which the Commercial Club committee can determine what a fair rate is.

The hearings are to be open to the public, and anyone who is qualified to do so may take part. The first hearing was set for Tuesday, Nov. 9.

Authority of Pennsylvania Commission Questioned

Authority of the Pennsylvania State Public Service Commission to pass upon contracts between municipalities and corporations or individuals furnishing public service of any kind has been attacked in the Dauphin County Court at Harrisburg in injunction proceedings brought against the commission by Abraham Fischer of Williamsport. Mr. Fischer petitioned the court for a decree declaring the clause of the public service act of 1913 governing approval of municipal contracts unconstitutional and void. The case involved a contract between the city of Williamsport and the Lycoming Edison Company for street lighting. Some time ago the Public Service Commission set aside a contract between the city and the Citizens' Electric Company and ordered readvertisement for bids. The Lycoming Edison Company underbid its rival, and the contract was awarded to it. Fischer asks to have the commission enjoined from acting on the contract.

Formation of N. E. L. A. Technical Section

A meeting of the executive committee of the proposed new Technical and Hydroelectric Section of the National Electric Light Association was held at the Engineers' Club, New York City, on Nov. 3, when there were present H. H. Scott, R. J. McClelland, Philip Torchio, I. E. Moultrop, J. T. Hutchings, Farley Osgood, P. M. Downing and Thomas Sproule of the committee and T. C. Martin and S. A. Sewall on behalf of the association. The committee had been requested by President E. W. Lloyd, in accordance with the recent authorization by the executive committee of the association, to organize the section, and the following officers were elected: Chairman, Holton H. Scott, Doherty Operating Company, New York; vice-chairmen, P. M. Downing, Pacific Gas & Electric Company, San Francisco; J. T. Hutchings, Rochester (N. Y.) Railway & Light Company; R. J. McClelland, Electric Bond & Share Company, New York, and Charles Ruffner, Electric Company of Missouri, Webster Groves, Mo.; secretary, S. A. Sewall, N. E. L. A. headquarters, New York City. These officers will constitute the governing body of the section until the regular election of officers by the section itself at the next annual convention.

All the technical members of the main association become members automatically of the new section, and new members will be added to the section on their personal choice. The technical membership of the association is by far the largest group, and the new section will consist of several thousand members. It will take under its jurisdiction practically all of the technical committees, such as those on overhead lines, prime movers, electrical apparatus, underground construction, grounding secondaries, electrical measurements, etc.

It was proposed by Philip Torchio, New York Edison Company, that a new committee be constituted to study and report on the newer industrial applications of electricity from the technical side so as to be of use in furnishing data and information to member companies and the Commercial Section. This proposition was very favorably considered.

Steps were taken to formulate a constitution for the section, and a variety of interesting business was discussed.

Municipal Projects Checked in Ohio

Last week's issue contained an account of the effect of the elections on utilities in Cincinnati, Toledo and Lorain, in Ohio. In addition interesting sidelights were thrown on the elections in Cleveland and Lima.

The election of H. L. Davis as Mayor of Cleveland will probably put an end to the cry for the exclusive municipal ownership of the light and power properties of that city. Mr. Davis is not an advocate of the municipal ownership of the public utilities nor of confiscatory rates for service, though he will doubtless insist on fair play for both the company and the public. The Public Utilities Commission will, therefore, be free to solve the problem that is now before it respecting the proper rate.

F. W. Ballard, light and heat commissioner of Cleveland, announced some time ago that he would probably retire at an early date, and since the election he has stated that he will open an office after Jan. 1 as a consulting engineer. He recently closed negotiations by which he will represent the city of Terre Haute, Ind., in negotiations pending between it and the company serving the city.

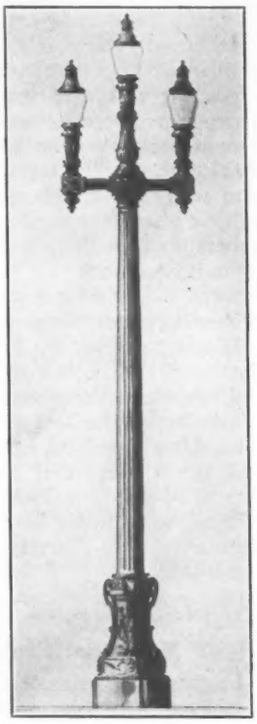
With a change of administration and policy relative to the Cleveland municipal plant, a complete investigation of the operation of the new central station will

probably be made, and through this the success or failure of municipal ownership and operation on a large scale may be determined.

At Lima, Ohio, the voters disapproved of a bond issue of $60,000 for the construction of a municipal plant and the establishment of a "white way" in the business district, by a vote of 3576 to 2777. At the same time a bond issue for the improvement of the fire department was carried.

Salt Lake City's New Arc-Lighting System

The Salt Lake City commission has formally declared its intention of carrying out the lighting improvement for District No. 2 in accordance with the special law passed by the last Legislature empowering it to do so. The petition to the commission asking for this improvement was signed by more than 50 per cent of the property owners in the district, so there is no likelihood that the action will be protested. The city engineer's office is now engaged in preparing an estimate of the cost of the improvement, which will be ready for advertisement shortly. This special district comprises Main Street from South Temple Street to Fifth South Street, a distance of five blocks, or 3960 ft. The proposed system contemplates the installation of fourteen special standards to the block, seven on each side of the street, the distance between posts being approximately 100 ft. Each standard will be equipped with three 6.6 amp. inverted-type luminous-arc lamps.



SALT LAKE CITY ARC-LAMP POST

The posts are of special design, as illustrated, and are arranged to fit over the trolley poles, the bottom of the bracket carrying the lamps coming just above the point where the span wire attaches to the pole. It is the intention when this system is completed to require the removal of all other posts and poles from the curb, so that this special lighting system will be the means of substituting for the present trolley pole, unsightly at the best, a highly decorative standard, and removing all other obstructions to the view. The height of the lamps will be 27 ft., and as the width of the street is 132 ft. between property lines, the squatty, narrow effect so usual where the lamps are mounted low will be avoided.

The cost of installation of the system is estimated at about $4 per front foot. This will be prorated, under the provisions of the law, against the property included in the district and will be collected as are other special assessments. The cost of maintenance and operation is estimated at $1.30 per front foot per year. A portion of this expense will be borne by the city in lieu of the street lighting for which it now pays. The balance will be prorated against the property, as is the installation cost.

The system was designed by W. D'A. Ryan, illuminating engineer for the Panama-Pacific International Exposition, who was commissioned by the Main Street property owners to produce a system second to none in the country. Work on the system will soon be under way.

ELECTRICAL PROSPERITY WEEK FEATURES

Twenty-two Cities Will Have Electric Shows, and Newspapers in Various Sections of the Country Plan Special Editions

The plans being developed in numerous cities throughout the country for participation in Electrical Prosperity Week are progressing at a rate that is surprising. The celebration will have many features never before seen in this country, and these are likely to prove not only highly entertaining but thoroughly instructive.

Collier's Weekly will issue a special advance edition in the interest of Prosperity Week, which by Nov. 15 will have gone to 25,000 central stations, dealers, contractors and jobbers. The edition will contain an editorial on the celebration, a letter from Thomas A. Edison indorsing the movement, news of what the cities are doing everywhere to participate, and many special advertisements from manufacturers.

It is a significant fact that this is the first time that any of the more widely circulated popular magazines ever gave so much prominence to a trade movement.

The following newspapers will bring out special editions for Prosperity Week: Los Angeles *Times*, Omaha *Daily News*, *Wisconsin State Journal*, Milwaukee *Sentinel*, Houston *Chronicle*, Pittsfield (Mass.) *Journal*, Brooklyn *Eagle*, Richmond *Times-Dispatch*, and the *Morning Republican* of Findlay, Ohio.

Electrical Shows

The electrical shows thus far definitely announced, together with the chairmen of the committees in charge, are as follows:

Atlanta, Ga.—Rawson Collier, Georgia Railway, Light & Power Company.

Cincinnati, Ohio—H. K. Shockley, manager Electrical Show, Chamber of Commerce.

Dayton, Ohio—Thomas F. Kelly, commercial manager Dayton Power & Light Company.

Duluth, Minn.—A. W. Lindgren, manager Northern Electrical Company.

Chattanooga, Tenn.—Howell Graham, chairman Jovian committee; L. J. Wilhoite, contract agent Chattanooga Railway & Light Company.

Denver, Col.—John M. Connelly, advertising manager Denver Gas & Electric Company.

Springfield, Ohio—J. E. North, commercial manager Springfield Light, Heat & Power Company.

Tampa, Fla.—P. F. Lyons, president; W. Finlay Hunter, secretary; Harry Mong, Cliff Buerke.

Sioux City, Iowa—George O. May, Electric Supply Company.

Trinidad, Col.—C. F. Donahue, chairman; S. J. Ballinger, H. J. Reed.

Fort Wayne, Ind.—E. F. Brinkman.

Tulsa, Okla.—Jesse L. Terry, Public Service Company.

Erie, Pa.—J. H. McCarthy, secretary Jovian League, P. O. box 537.

Louisville, Ky.—Robert Montgomery, commercial manager Louisville Gas & Electric Company.

Milwaukee, Wis.—H. P. Andrae, Julius Andrae & Sons Company.

Memphis, Tenn.—W. R. Herstein, Electric Supply Company; Carl K. Chapin, Memphis Consolidated Gas & Electric Company.

Richmond, Va.—George A. Tower, chairman Electric Show and parade committee.

Norfolk, Va.—Meeks & Reed.

New Castle, Pa.—Louis B. Round, New Castle Electric Company.

Peoria, Ill.—City Electrician Wolgamott.

Pittsfield, Mass.—H. W. Derry, contract agent Pittsfield Electric Company (Jovians).

Sandusky, Ohio—E. A. Bechstein, chairman show committee; E. P. Brohl, C. F. Donahue, R. C. Beebe, J. T. Sloat, E. Burt Fenton, Sandusky Gas & Electric Company.

At Denver, Col., a miniature mine will show the electric hoists, rotary diamond drills, coal cutters and all

the machinery used in an up-to-date coal mine. Students from the School of Mines and other universities of the State are planning to attend the exposition in bodies to study the various phases of electrical development, and the professors are showing interest and encouraging the students in every way to use the opportunity for the study of electricity in its various forms as demonstrated at the exposition. There will be working demonstrations also of water-power, showing the force which for years went to waste in Colorado now being used for moving the vast machinery of the State.

In Findlay, Ohio, festoons of red and green bulbs are to swing across Main Street every hundred feet from the Cincinnati, Hamilton & Dayton Railroad on the north to Hardin Street on the south. Electrically lighted pageants are to take place in the evenings. A Mardi Gras carnival is planned for one night, and an electric sign proclaiming Findlay's prosperity is to be erected above the Main Street bridge.

A feature arranged for the celebration at Trinidad, Col., will be a huge searchlamp mounted where it can play on the business district during the celebration. Other searchlamps will be mounted on the tops of buildings. An automobile parade has been planned which promises to be the principal event.

In Birmingham, Ala., it is planned to have the churches, schools, stores and factories turn on all lamps each night of the week. There will also be demonstrations and an electrical parade.

An interesting feature of the celebration at Cincinnati, Ohio, will be an electric fountain, 28 ft. high, on the Fountain esplanade. Sparkling electric lights will represent the falling water.

Plans of the Commonwealth Edison Company

The plans of the Commonwealth Edison Company of Chicago for making Electrical Prosperity Week a live one in that city are now well under way. The Commonwealth Edison Company itself expects to give as a premium some electrical appliance to everyone signing a house-wiring contract during this week either with the company's own solicitors or with the solicitors of either of the two large contractors' associations in the city. Customers who buy $10 worth of electrical merchandise at any of the company's stores during the week will receive a coupon entitling them to $1 worth of additional merchandise, while purchasers of merchandise amounting to between $5 and $10 will receive a 50-cent coupon.

Co-operation of all electrical merchants in the city, from the big department stores to the smallest dealer, is being sought. It is assured that all of the five electric stores of the Commonwealth Edison Company will have special window trims, and every effort is being made to supply the small dealers and the department stores with material for electrical windows.

To attract popular attention to the movement a large amount of space in the daily papers and in the theater programs has been contracted for, for both Electrical Prosperity Week and the week just preceding it. Arrangements have been made to distribute circular advertising matter through all of the company's drug-store sub-agencies. The message of the industry will also be flashed electrically to the public by means of the company's two large motograph signs.

Workmen have been laboring night and day to complete the outline lighting which has been started on the company's new building, and it is hoped that this spectacular illumination will be finished in time to add its glow to the general illumination planned for the week.

The work of preparation is being carried on under the direct supervision of John F. Gilchrist and E. W. Lloyd, and the immediate arrangements are in the hands of a committee composed of O. R. Hogue, E. A. Edkins, D. H. Howard and G. B. Johnson.

Plans of Washing-Machine Manufacturer

The fact that Electrical Prosperity Week is providing an adequate vehicle for those who have special selling plans to carry into effect has been demonstrated by Neil C. Hurley of the Hurley Machine Company, Chicago. Hitting upon the idea of conducting a window display contest featuring "Thor" electric washing machines during Prosperity Week, Mr. Hurley put his plans before the electrical supply dealers who had windows to dress. The plans stipulated that a "Thor" washer purchased especially for the occasion should be used for the central feature of the display. The time of payment on this display machine was purposely set far ahead, Feb. 1, in order to give ample time to dispose of the machine before being called on to pay for it. Cash prizes were offered to winners of the contest. As a direct result of this offer 512 machines were sold before Nov. 5, and Mr. Hurley stated that he confidently expects to have at least 750 entries in the window-display contest. These special selling plans will on that assumption cause the sale of about $60,000 worth of merchandise figured at list price.

When asked about the effect of the Electrical Prosperity Week propaganda on the business of the Hughes Electric Heating Company, Chicago, Abner Vaughn, sales manager for the company, said: "There can be no doubt that the effect produced has been widespread. Almost from the four corners of this country we have received notices of plans for electric shows incorporating electric-cooking demonstrations as one of the features. The movement does not seem to confine itself to any one branch of the industry. Indications are that contractors, dealers and central stations alike are planning to use Electrical Prosperity Week to popularize electrical appliances. The ranges we have been called upon to supply to meet the demand for the week vary in size from our largest standard product to the toy ranges which are being marketed by the Western Electric Company."

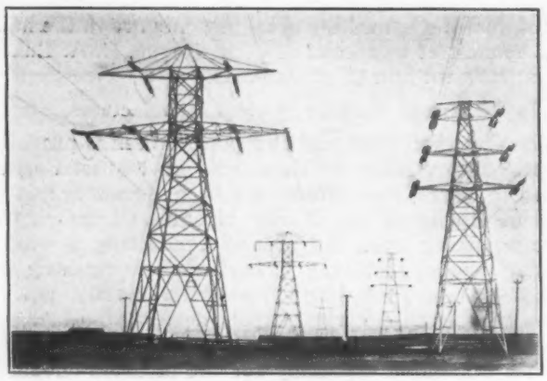
Parade at Louisville

More than 100 floats are expected to be in line in the parade with which, on the night of Nov. 29, the Jovians of Louisville will initiate Electrical Prosperity Week in the Kentucky city. It had been the intention of the committee in charge of the proceedings to leave the parade for a day later in the week, but further consideration has made the parade first on the list. The demonstration for the remainder of the week will center about the display at the armory. Much general interest is being shown in the preparations for the week, and public interest is being aroused.

Court Upholds New Jersey Commission

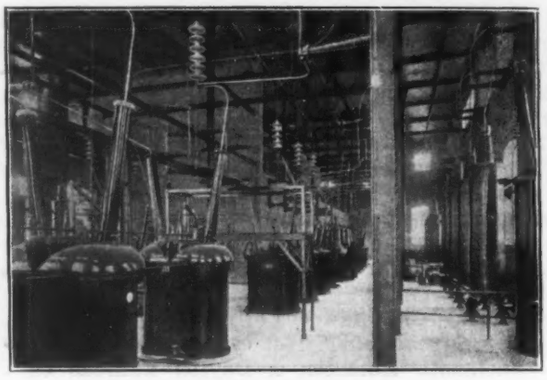
A case involving the question of rates given by utilities to municipalities was recently decided in New Jersey when the Public Utilities Commission of that State was upheld by the State Supreme Court in its order fixing a water rate of 30 cents per 1000 gal. in North Wildwood.

The municipality contested the order on the ground that it had a contract with the water company fixing a maximum rate of 25 cents. The court held that, as the creator of the water company, the Legislature has the power to waive the contract as to the city. The court admitted that a different question would have been involved had the company pleaded the contract as a bar to making a lower rate than therein stipulated.



LINES IN NIAGARA DISTRICT OF ONTARIO

Steel-tower construction characterizes the principal circuits of the commission's system for transmitting Niagara energy.



HIGH-TENSION ROOM OF SUBSTATION

Oil switches for controlling outgoing energy at the London (Ont.) station of the Ontario Hydro-Electric Commission.

HYDRO-ELECTRIC POWER IN ONTARIO

Sir Adam Beck, Chairman of the Commission, in an Interview Tells of Progress in Distribution of Niagara Energy in Canada

The Hydro-Electric Power Commission of the Province of Ontario, Canada, has since it was created in May, 1906, made a steady growth and at the present time is supplying cheap hydroelectric energy to more than 130 municipalities, new towns and cities being tied in continually.

Sir Adam Beck, who has been chairman of the commisson since its incorporation, outlined to a representative of the ELECTRICAL WORLD some of the new developments, some plans of the commission, and told in a general way how and why the commission was progressing. He said:

"The latest improvement to the commission's system is the new plant at Eugenie Falls, which is in the northern part of the Province just south of Georgian Bay. This plant, which will be able to supply a peak load of 10,000 hp., will begin operations on Nov. 18 by supplying energy to ten or fifteen municipalities. The turbines used have a rating of 2250 hp. each. They are of the reaction type with spiral wheel cases and overhung runners and of Swiss manufacture. The storage basin of the development is about 1650 acres in area and is created by two dams.

Load of Canadian Niagara District Reaches 100,000 Hp.

"The maximum load in the Niagara district, which is bounded by Niagara Falls, Toronto and Windsor, is over 100,000 hp. and was reached last week for the first time. During December the peak load in this district will reach a maximum of 110,000 hp.

"The commission receives most of its supply from the Ontario Power Company, at Niagara Falls, with which it has a thirty-year contract to supply 100,000 hp. at a minimum of $9 per hp.-year. In addition, the commission has three power developments of its own but of a much smaller size.

"The limit of the present supply of available power is now practically reached, and the peak any time now threatens to exceed our contracts. With a full realization of this situation and wishing to effect a suitable remedy, the provincial government requested the commission to lay before it plans for the further development of Ontario's hydroelectric resources. The commission recommended a scheme of new development at Niagara Falls in which the initial installation of 150,000 hp. would with the present sources of supply take care of a peak of 300,000 hp. The ultimate rating of this development as recommended amounts to 600,000 hp. This entire development will be used only to supply the Niagara district, the remaining districts being fed from other sources.

"The commission is now supplying energy in more than 130 municipalities, and new ones are being connected in this system all the time. Many of these places formerly were supplied from central stations, but when it was found that there were large possibilities for supplying energy both in the cities and in the rural districts for farm work, the municipalities took over the privately owned enterprises.

"It must not be thought that I am now recommending public ownership of utilities as a principle. We have succeeded in this plan of public ownership only because the entire system has been conducted on a business basis to the exclusion of politics and personal privilege. Why, at any time at all our books must be open to any or all of the accountants of the 130 municipalities on our lines.

"Each year we are able to show a large surplus after paying all expenses including interest, a 5 per cent depreciation charge, a sinking-fund reserve, and a large sum to pay off the debentures which were a liability of the system when we took hold of it.

"The system is not run for a profit but for the benefit of the consumers. While it is controlled by the Province of Ontario, the government in no way shares in its revenue except to collect the interest due it on its loans to the system and the principal of the loan, which must be liquidated in forty years from the time it was made. Any surplus left after the payment of all charges is put back into the system's property to pay for betterments and improvements.

Average Monthly Household Bill 98 Cents

"Our low rates have been instrumental in increasing our rural and domestic load. First, we charge a service charge of 30 cents per 1000 sq. ft. floor area for domestic service, with a minimum of 30 cents. To small consumers the rate is 2 cents per kilowatt-hour for the first 30 kw.-hr. and 1 cent per kilowatt-hour for all over that. A large householder, however, pays 2 cents per unit for the first 100 kw-.hr. and 1 cent for all over that. With such rates most of our customers are now using electricity for heating and cooking as well as for lighting. An average of fifty families, averaging six to a family, showed a monthly bill of $1.67 for cooking, while the average household bill, including service charge, is 98 cents. With these rates the commission was able to show last year a net surplus of more than $21,000.

"Take my own home for instance. My bill for September was $7.11, as follows: service charge, 90 cents; first 100 kw.-hr., $2; second 500 kw.-hr., $5. This totals $7.90, or, less 10 per cent for prompt payment,

THE NEW DEVELOPMENT AT EUGENIE FALLS

Construction begun in spring of 1914, this plant will commence operation Nov. 18, 1915, to serve the neighboring district.

MOTOR SUPPLANTS STEAM THRESHING ENGINE

Many farms served by the commission's lines are now using electricity for all power purposes about the barn and field.

$7.11. We used energy for lighting, cooking, bathroom heating, around the stables, and for all of the miscellaneous household heating devices. This is not unusual for a family with a large place and many servants.

"In the rural districts the use of energy is becoming quite common. There are so many uses for electricity on the farm that its use is becoming almost universal in the districts served by our lines. Most of the farms use a 5-hp. motor, which they employ in pumping, sawing, food grinding, silo loading and a multitude of other ways. The average monthly bill for these farms is around $8 or $9. I have in mind a sanitarium farm on our lines which has about fifty patients. This farm uses energy for cooking, laundry work, farm work and lighting, and its monthly bill is around $23.

"We have placed in the hands of the householder electrical energy at such rates that gas competition becomes impossible, and within a few years I expect to see all households in our districts using electricity universally for lighting, cooking and heating."

Commercial Engineering Course of National Electric Light Association

The National Electric Light Association's Commercial Section's committee on education of salesmen, after investigating various methods for educating and for increasing the efficiency of employees, has now begun the publication and sale of a commercial engineering course to be conducted by correspondence. The lessons of this course will be compiled and will be conducted for the National Electric Light Association by the Chicago Central Station Institute. The course consists of seventeen lessons on the following topics: Salesmanship, selling campaigns, locating and following up prospective customers, advertising, merchandising, relations to customers, meters and metering, rates, illuminants, comparative costs of illuminants, principles of illumination, lighting practice, electric signs, wiring, motors, steam, gas and oil engines, and isolated plants. The first lesson has just been issued and the remainder will follow at regular intervals. The greater part of the material used in this course is said to be unobtainable elsewhere, and the low fee ($12) is accepted mainly because the material has been largely donated by members of the National Electric Light Association. Any employee of any member company may avail himself of the advantages offered by the course. Fred R. Jenkins, 72 West Adams Street, Chicago, Ill., is chairman of the committee on the education of salesmen.

Membership Campaign for Engineers' Club of Philadelphia

A systematized four-day campaign to obtain a thousand new members for the Engineers' Club of Philadelphia, with the intent of making it the technical center of engineering activity in that city, will shortly be inaugurated.

The leaders say that there are about 10,000 men in Philadelphia who are engaged either in the engineering profession or in professions akin to it, and that 1000 of these will be glad to become members when they learn of the recent affiliation of the Philadelphia organization with national engineering societies in the exchange of technical discussion and information.

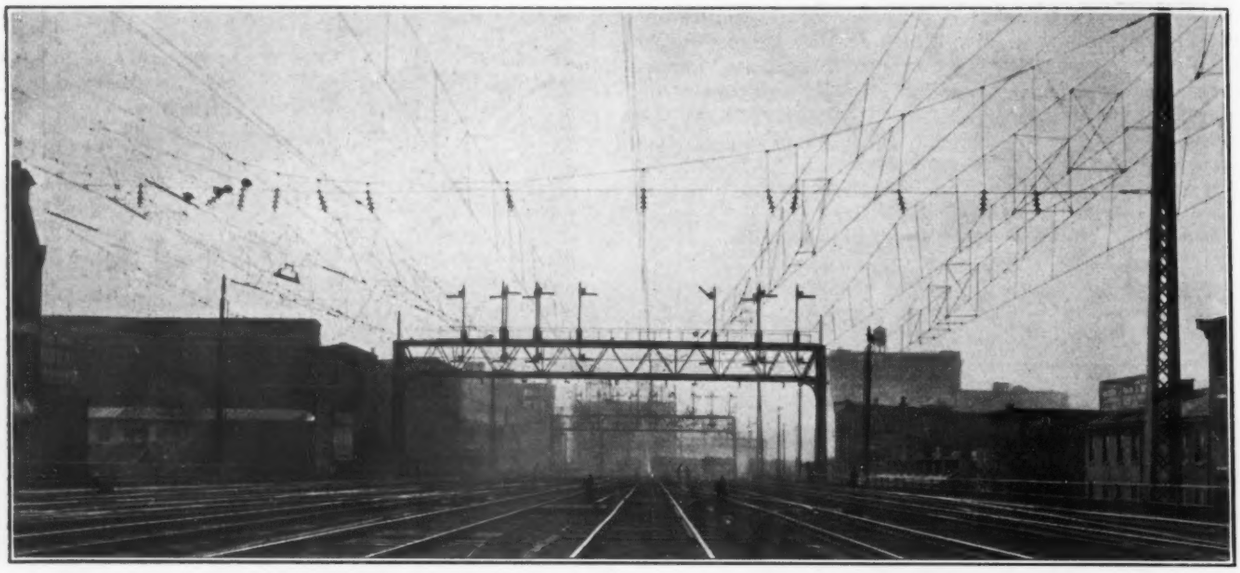
The Engineers' Club of Philadelphia is the oldest technical society in the State of Pennsylvania. It was organized in 1877 and stands very high in the opinion of engineers all over the United States as one of the most advanced technical clubs in the country. At present it has a membership of 570 men, without reference to its recent affiliation with the Philadelphia sections of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the Illuminating Engineers' Society, the Technology Club and the American Society of Marine Draftsmen.

The club desires to be of service to the muncipality in the important construction problems to be solved during the next few years, and feels that this can best be accomplished by the increased membership desired.

Setting and Sighting a Heavy 35-Ft. Juniper Pole in 11.8 Seconds

In the pole-setting contest held during the recent outing of the Buffalo General Electric Company teams were entered by the Buffalo company, the Cataract Power & Conduit Company and the Niagara Falls Electric Light & Power Company. The contest had as its primary object the bringing together of the teams of the several companies in order that each crew might observe the different methods, if any, employed by the others and benefit thereby.

The holes were dug in advance, and each crew started with its pole butted and lying on the ground. The pole used by the winning team of the Buffalo General Electric Company was a fresh juniper stick which in weight was almost as heavy as a chestnut timber. It measured 35 ft. 6 in. long and 43.5 in. in girth 6 ft. from the butt and 31.5 in. in girth 6 ft. from the top. This pole was raised and perfectly aligned in 11.8 seconds.



Pennsylvania Electrification at Philadelphia

Economy of Electrified Suburban Service—Engineering Features of Energy Supply and Transmission—Substations for Single-Phase Operation from Three-Phase System

THE use of electrical energy by railroads for the operation of main and branch lines presents interesting engineering problems in generation and distribution, and results in certain economies in railroad operation. The electrification of 93 miles of track by the Pennsylvania Railroad on the suburban section between the Broad Street station in Philadelphia and Paoli serves to accentuate these features. Energy is purchased from the Philadelphia Electric Company and is supplied from its new Christian Street station. The generating arrangement in this station to handle the load and the installation of turbo-generators of large rating were described in the May 30, 1914, and the Oct. 9, 1915, issues of the ELECTRICAL WORLD.

The electrification of the section of the Pennsylvania lines mentioned has resulted in an estimated saving over steam operating costs sufficient to pay interest on the necessary investment. The substitution of motor-car trains for those hauled by locomotives and the elimination of the shifting back and forth from one track to another of cars and the movement of empty trains have resulted in a relief at the main railway station in Philadelphia equivalent to increasing the station capacity from 17 to 19 per cent of the Paoli suburban service, and for the station as a whole equivalent to reducing the total number of trains by about 8 per cent. A similar increase in capacity has been estimated from the electrification of other suburban lines, and work in connection with one of these—namely, the Chestnut Hill line—has already commenced. Relief thus afforded by electrification of the Paoli and Chestnut Hill lines is considered sufficient to take care of the normal growth of business for the next seven or eight years.

Single-Phase Operation

The general features of the Pennsylvania electrification include the use of 11,000-volt, single-phase, twenty-five-cycle energy supplied directly to the train from an

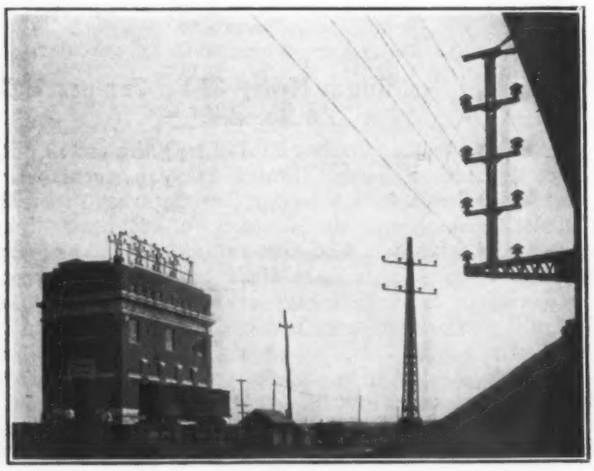


FIG. 1—STEP-UP SUBSTATION RECEIVING ENERGY FROM PHILADELPHIA ELECTRIC COMPANY—THE BRACKETS ON ELEVATED STRUCTURE SUPPORT 44,000-VOLT CONDUCTORS

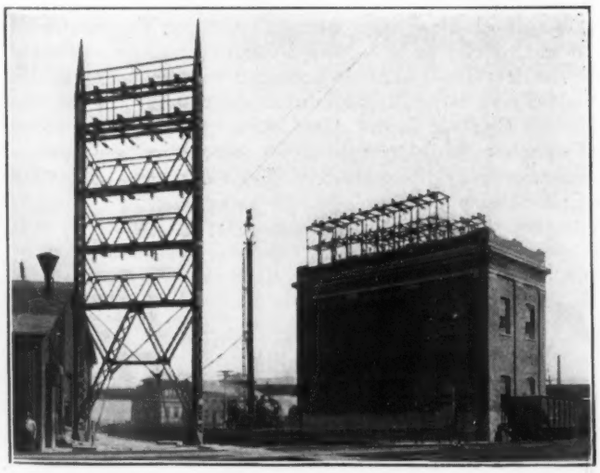


FIG. 2—STEP-DOWN SUBSTATION AT WEST PHILADELPHIA AND SUPPORTING TOWER FOR 44,000-VOLT INCOMING LINES AND OUTGOING 11,000-VOLT TROLLEY FEEDERS

overhead catenary trolley system and the elimination of moving machinery in substations for the furnishing of this energy. In selecting the system primary importance was attached to possible long-distance operation over the entire divisions affected, rather than to the requirements for the present short suburban electric service.

The main feeders from the Christian Street generating station of the Philadelphia Electric Company lead to a substation of the railroad company on the west bank of the Schuylkill River opposite the generating station. The circuits consist of four 350,000-circ. mil three-conductor armored submarine cables under the river. Energy is delivered to the railroad company's substation at 13,200 volts, where it is stepped up to 44,000 volts and transmitted to step-down substations. The present service is furnished from one phase of the central-station company's three-phase system with the necessary arrangements to balance this single-phase load, as well as to correct for the relatively low power-factor. According to present plans, the energy requirements of future electrifications will be supplied from the remaining phases of the system.

The Arsenal Bridge substation, which receives the energy from the Philadelphia Electric Company's power station, is shown in Fig. 1. The layout of circuits and apparatus in this substation is shown in Fig. 3, together with arrangements to furnish single-phase energy to the different trolley circuits from the substations at West Philadelphia, Bryn Mawr and Paoli. From the Arsenal Bridge substation four 44,000-volt single-phase transmission lines lead to the West Philadelphia substation. At this point arrangements are provided for extending two of these lines to the Chestnut Hill substation. The remaining two lines continue to the Bryn Mawr and Paoli substations as shown.

44,000-Volt Transmission to Substations

Arrangements for carrying the four transmission lines between the Arsenal Bridge and West Philadelphia substations on brackets at the side of the elevated structure are shown in Fig. 2. Beyond the West Philadelphia substation the two lines are carried, one on each side of the tracks, on the catenary supporting structures, as shown in Fig. 5. Horn-gap switches for sectionalizing are installed on the roofs of the various substations, together with the necessary lightning-arrester equipment. A typical layout of this arrangement is shown in Fig. 4.

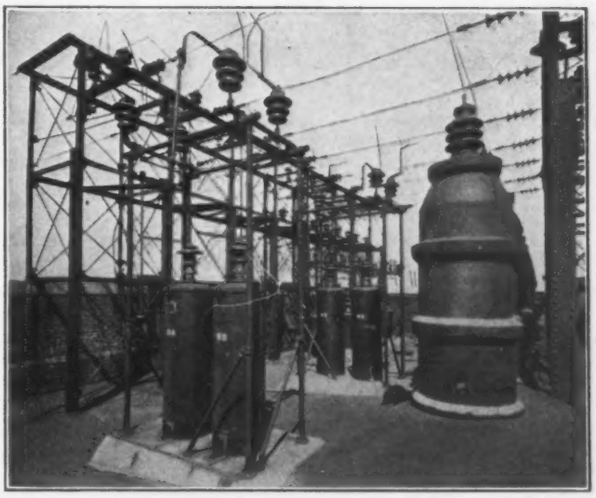


FIG. 4—SECTIONALIZING HORN-GAP SWITCHES AND LIGHTNING ARRESTER LAYOUT ON SUBSTATION ROOFS

The 44,000-volt transmission line conductors are No. 2-0 seven-strand hard-drawn copper cables spaced 5 ft. apart where the two wires of a single-phase feeder are on the same cross-arm. Where there is more than one circuit on a pole the vertical spacing is 3 ft. 6 in. The lines are protected by a ⅜-in. steel ground wire run on the top of the poles.

At the Arsenal Bridge substation the lines are protected by relays which operate on overload and on an unbalanced load in either leg caused by a ground. In the other substations the relays operate only differentially, and in case of a ground between substations the circuit on which the trouble occurs is cut out first in three of the substations, and finally at the Arsenal Bridge substation. Overload relays are provided in the 13,200-volt lines at the Philadelphia Electric Com-

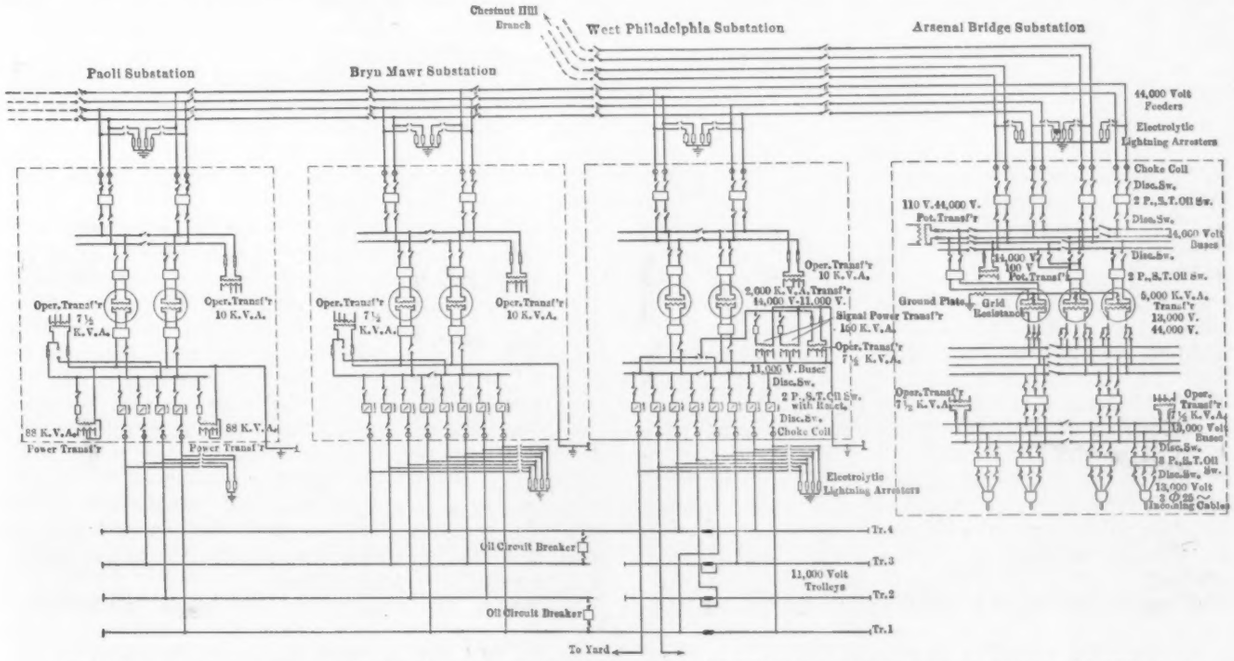
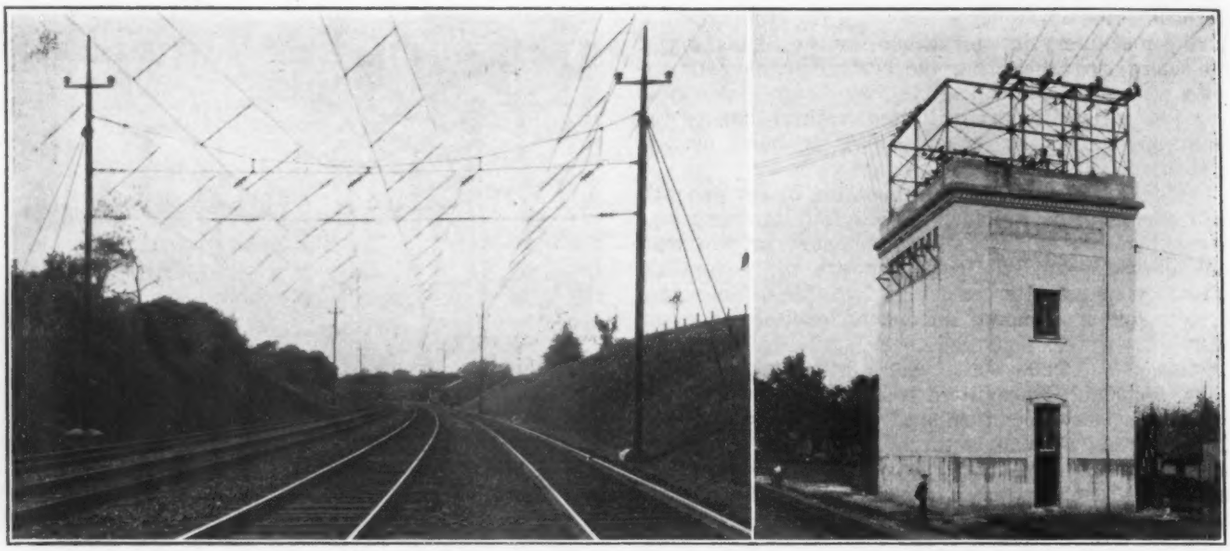


FIG. 3—GENERAL ARRANGEMENT OF SUBSTATIONS, SHOWING 13,200-VOLT CABLE CONNECTIONS, 44,000-VOLT TRANSMISSION LINES, AND 11,000-VOLT TROLLEY FEEDERS



FIGS. 5 AND 6—SHOWING TRANSMISSION LINE ON EACH SIDE OF TRACK ON CATENARY-SUPPORTING STRUCTURE AND PAOLI STEP-DOWN SUBSTATION

pany's power station, and the reverse current relays in these feeders at the Arsenal Bridge substation. The pin-type porcelain insulators used on the transmission lines are 8 7/16 in. high, and 12 in. in diameter and are made up of four parts. The lines were designed to stand a potential of 66,000 volts, or three times the working pressure to ground.

Substation Equipment

The substations are of substantial fireproof brick construction and are adjacent to the tracks, as shown in Fig. 6. The lightning-arrester equipment and high-tension feeder-sectionalizing switches are installed on the roof, the busbars and switching equipment on the second floor, and transformers on the ground floor. Space is provided in all of the substations for 100 per cent increase in rating. The substation at Arsenal Bridge contains three 5000-kva. step-up transformers, while those at West Philadelphia, Bryn Mawr and Paoli each contain two 2000-kva. step-down transformers. These transformers are of the twenty-five-cycle, single-phase, oil-insulated, water-cooled type. Except in the case of the Arsenal Bridge substation, the primaries of step-down transformers are wound for 44,000 volts and the secondaries for 11,000 volts. In the Arsenal Bridge substation the primaries are wound for 13,000 volts and the secondaries for 44,000 volts. Voltage taps are provided on the primary and secondary coils of all transformers. The neutral point of the high-tension winding of the step-up transformers is grounded through a grid resistance, thus limiting the potential to ground from either side of the 44,000-volt transmission lines to 22,000 volts. Oil filtering and drying apparatus is installed in each substation, and a tank is provided into which the oil may be drawn from the different units.

The 44,000-volt circuits are connected to the buses in the various substations through oil circuit-breakers arranged along the floor without barriers. The circuit-breakers of the 11,000-volt and 13,000-volt circuits are of the oil type, those on the 11,000-volt trolley circuits being two-pole with the reactance connected across one pole. The circuit-breakers are automatic and remote-controlled.

The bus arrangement in the different substations consists of open buses mounted on insulators carried on pipe framework. All wiring is bare, and copper tubing or solid wire is used. Sufficient clearance has been provided so that no barriers are required between buses or wires except in the case of the incoming cables from the Philadelphia Electric Company's station in the Arsenal Bridge substation. The control, instrument and lighting conductors are rubber-insulated and run in conduit.

The 44,000-volt and 11,000-volt buses are sectionalized in each station, with normal operation providing for these bus-disconnecting switches closed. In the step-down substation one transformer is connected to each side of the bus, and one leg of the 11,000-volt side of all step-down transformers is connected to a bus through a disconnecting switch. This bus is connected to the track rails.

Steel-Coach Motor Equipment

Standard suburban steel coaches of the type used in steam service have been used for the electric service without structural changes. This was possible because of the fact that requirements for mounting electrical apparatus on cars had been considered at the time steel cars were adopted by the railroad company. The equipment of each car consists of two single-phase air-blast-cooled doubly-fed motors, of an hourly rating of 225 hp. and a continuous rating of 200 hp., mounted on one truck with automatic acceleration, battery-control equipment and automatic multiple-unit electric air-brake equipment. The cars are designed for double-end operation on a 11,000-volt, twenty-five-cycle overhead trolley line, using a pantograph trolley.

The motors are connected in series and started and operated up to approximately 15 miles per hour as repulsion motors, with the auxiliary or compensating field, the armature and the main field in series. With these series connections the armature is short-circuited through resistance. Resistance is also inserted in series with the motors on the first step and is cut out on the second step. The third step changes the connections to energize the auxiliary field from one portion of the transformer and the armature and main field, connected in series, from another portion of the transformer, thus affording doubly fed connections. The armature short-circuit is removed when operation is by doubly fed motors. The subsequent steps are obtained by increasing the motor voltages.

The design and construction of the electric installation was carried out by Gibbs & Hill, consulting engineers for the Pennsylvania Railroad Company, in cooperation with the engineering department and the officials of the road.

Insulator Performance from Operating Viewpoint

Insulator Troubles—Tests to Weed Out Defective Units—Interpretation of High-Frequency Effects—Practical Features of Testing

BY E. P. PECK, SUPERINTENDENT OF TESTS AND REPAIRS GEORGIA RAILWAY & POWER CO.

THE careful study of transmission-line insulator testing that has been conducted by the Georgia Railway & Power Company for some years was brought about because of considerable trouble on some of its high-tension lines and a desire to find one or more types of insulators which would satisfactorily stand the operating conditions encountered. Some 300 miles of lines are operated in the State of Georgia at voltages of 11,000, 22,000, 66,000 and 110,000, with a large number of different types of insulators. This demands the carrying of a varied stock of both insulators and line hardware.

The tests which have been made cover all of the types of insulators that have been used on the lines mentioned and intended for operation at 11,000 volts and above. As a result of these tests the required designs of high-voltage insulators have been standardized so that not more than four types are required. These types have been selected in such a way that each may be secured from more than one manufacturer.

Some Operating Troubles

In one case a 22,000-volt line, which is approximately 63 miles long, showed conclusively that voltages many times the normal line voltage were being impressed on the insulators. One section of this line was insulated with two suspension insulators in series, this string of insulators needing not less than 180,000 volts to flash over. In several instances these strings have flashed over when the operating voltage was in the neighborhood of 23,000. During one series of troubles twenty-five insulators were changed on account of showing faults. Our experience with this line particularly has shown that there are factors, other than the normal line voltage, which are very important in determining the size and kind of insulator to be used. It is now being recognized that the amount of power applied to a line, the length of the line and the size of the wire are, perhaps, as important features as the operating voltage.

The testing of insulators has received a large amount of study and investigation work along new lines in recent years, and some of the manufacturers are now offering insulators which very satisfactorily stand severe tests. The testing of insulators with high-frequency test transformers, however, is comparatively new and has not yet received the sanction of all of the insulator manufacturers or the official sanction of the American Institute of Electrical Engineers. This method of test has been largely developed and well described by Prof. E. E. F. Creighton. A number of other writers have described tests with this equipment, but all of them do not favor the oscillation transformer. It is noted, however, that as the manufacturers improve their product so that insulators will stand the oscillation transformer test the objections to its use are less frequent.

Advantages of Testing Insulators at High Frequency

One of the great advantages of this method of testing is that it can be standardized for both the maker and the user. Operating companies cannot, in general, equip testing departments with sixty-cycle transformers for insulator testing which will give the necessary high voltage, and it is out of the question to use these large transformers at the various distributing points. The oscillation transformer, however, can be set up in a stock room or used by line crews, the insulators being tested immediately before they are placed on the line. The best reason for the use of the oscillation transformer is that it will detect faulty insulators which cannot be weeded out by a sixty-cycle test.

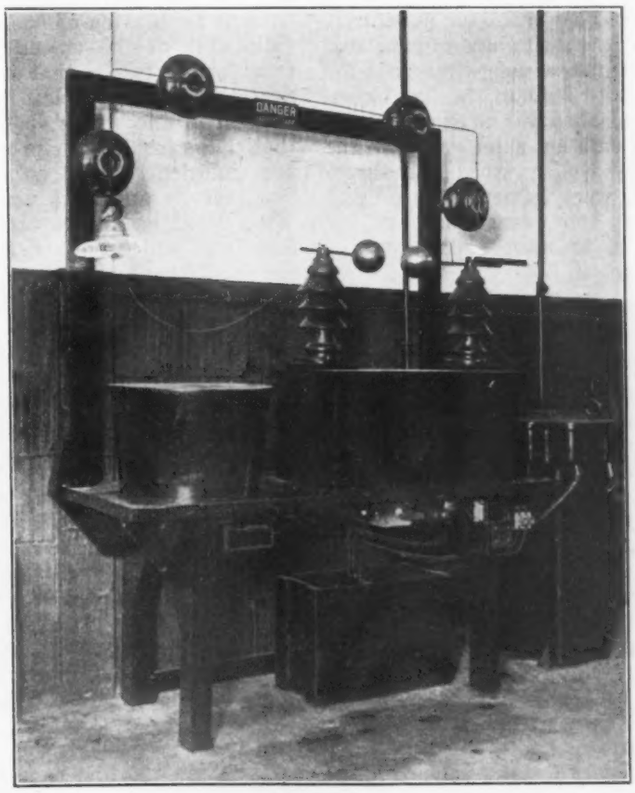


FIG. 1—OSCILLATION TRANSFORMER TESTING OUTFIT USED BY GEORGIA RAILWAY & POWER COMPANY, SHOWING INSULATOR UNDER TEST

This outfit is installed in the company's laboratory and used for testing single units up to 300,000 volts at 200,000 cycles. At the left is shown the oil tank for puncturing insulators.

The first series of tests made by the writer with the oscillator was for the purpose of determining the best insulator for the line conditions met with. After the better types were picked out a second series of tests was made to standardize the testing method. It seemed advisable to apply tests which would weed out all defective insulators but would not damage the good insulators. Some of the tests applied to the various insulators and the steps taken in conducting them for the purpose of studying insulator characteristics will be described. The voltage for these tests was supplied from an oscillation transformer giving a frequency of approximately 200,000 cycles and applied to the insulator at a value very much below its flash-over value. This voltage was then gradually raised until corona began to form on some part of the insulator, the pressure at which corona became vis-

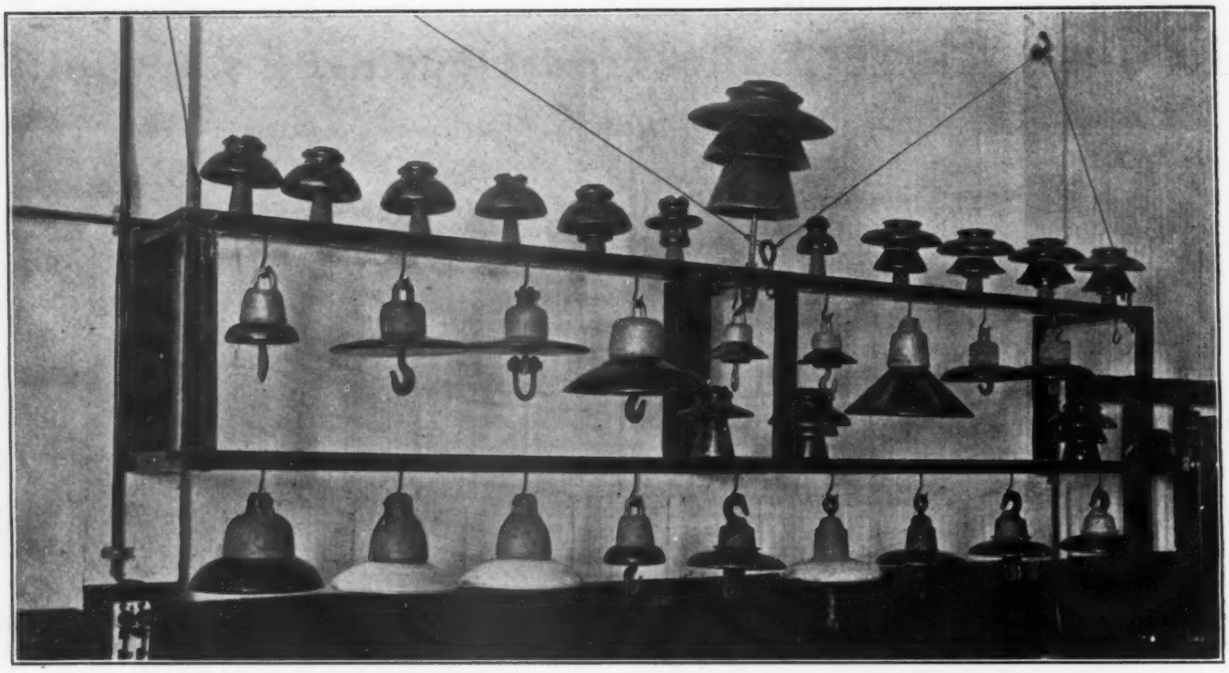


FIG. 2—TYPES OF INSULATORS THAT HAVE BEEN TESTED BY GEORGIA RAILWAY & POWER COMPANY

The insulators on the top row, while apparently of the same type, are all different and are samples from a number of makers. In the second and third rows different designs of suspension units are shown, numbers two and three from the left of the third row being the only duplicates.

ible being noted. The voltage was then raised until an occasional flash-over took place. This voltage and the appearance of the arc on the flash-over were noted. Finally the voltage was raised so that the insulator flashed over continuously and vigorously, and this voltage was held until the insulator punctured, or was applied for one minute, with one-minute rest intervals, for three hours. On these long-time tests the insulators became too warm to hold in the hand comfortably. The temperature reached was no greater, however, than would be reached on a hot summer day in the sunshine. These insulators, which stood the three-hour application of voltage, were immersed in oil and tested. In the oil-bath test the voltage used at the start was of such a value as to cause a flash-over in air. This voltage was raised, in 5000-volt steps, until the insulator punctured, the time of application of each voltage being two seconds.

Insulator Performance Shown by High-Frequency Tests

These tests showed a great difference in the performance of the insulators. It was noted that some insulators which had been giving trouble on the line owing to the inner petticoats breaking showed a definite corona around these petticoats at a voltage much below the flash-over voltage. In fact, on some insulators the inner petticoat could be made to flash almost continuously without flashing over the outer petticoat. It was noted, also, that other insulators showed very little corona previous to the flash-over of the insulator. Some of the insulators showing this characteristic have given excellent results in service.

Service results observed by the writer have shown that an insulator, or string of insulators, which has a high ratio of flash-over voltage in air to puncture voltage under oil is necessary. There has been some objection to taking this ratio as one of the points of value in an insulator, the objection made to the puncture value under oil being that the electrical stress on the different parts of the insulator is very largely changed by the oil bath. However, the electrical strength of the porcelain cannot be determined in an insulator unless the discharge over its surface is prevented. It is also necessary that the voltage strain which is applied to the insulator when it flashes over must be very much below the puncture voltage of the insulator. If this is not the case, the insulator will be weakened by continuous application of flash-over voltage and will finally fail. One of the objections raised to the oscillation transformer test is that it can be made so severe that perfectly good porcelain will be broken down. The opinion of the writer, based on a number of tests, is that if the insulator is properly designed and the porcelain sufficiently good no damage will be done to the insulator by any tests which can be applied with our 300,000-volt oscillation transformer. We have several insulators which have stood a test of several hours on the oscillation transformer. After several days or several weeks the insulators would be put on another long-time test. This has been repeated several times and the insulators are still found in good condition. Other insulators which would stand a five-second or a ten-second test on the oscillator would not stand a thirty-second test at flash-over voltage.

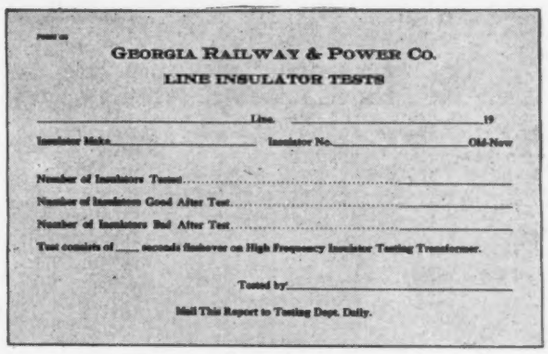
Insulator Failures on Lines

It has been found that some insulators which stand all electrical tests satisfactorily when new show a large percentage of failures after having been installed on the line for some years. Some of the old insulators fail through the inner petticoat, some through the head of the outer petticoat, and some puncture entirely through the head when test voltage is applied. One type of insulators, particularly, shows a large percentage of failures due to cracking around the tie-wire groove.

A number of suspension insulators which have been damaged on the line have skirts broken on account of the arc playing over these parts after the initial flash-over. This trouble is largely eliminated if the insulators are very closely spaced, that is, if the string length is as short as possible and some form of arcing horn provided.

As a result of a large number of tests made, it has

been decided to fix the voltage of an oscillation transformer for use on the line at about 150 kv. and to apply flash-over voltage from this transformer to all insulators for five seconds. This is a routine test now used and applied to all new insulators before they are installed on the line. It is also applied to all old insulators, which are taken down before they are used



GEORGIA RAILWAY & POWER CO.
LINE INSULATOR TESTS

Line. 19
Insulator Make. Insulator No. Old-New
Number of Insulators Tested.
Number of Insulators Good After Test.
Number of Insulators Bad After Test.
Test consists of ____ seconds flashover on High Frequency Insulator Testing Transformer.
Tested by:
Mail This Report to Testing Dept. Daily.

FIG. 3—FORM USED BY LINEMEN WHEN TESTING INSULATORS AWAY FROM THE LABORATORY

again. A form shown in an accompanying illustration is filled out by the men in charge of these tests, and in this way a comparison of the life of the various insulators in different classes of service is now being obtained.

The writer is attempting to duplicate the line conditions in the laboratory by applying strain, vibration, temperature-change and electrical tests. One of these tests or some combination of them is applied to the insulators to determine, in a few days in the laboratory, the insulator which will stand most satisfactorily several years of service on the line.

The extremely high voltage which is produced on lines is undoubtedly due to high-frequency disturbances, as these disturbances are produced on circuits having appreciably high capacity and reactance and are nearly always caused in the first place by an arc to ground. It is very probable that in some cases the shape of the voltage wave is very similar to that produced by the oscillation transformer. In most cases of extremely high voltage the wave shape of the voltage probably approaches much nearer to that of the oscillation transformer than it does to the line voltage. If this is the case and the insulators receive these abrupt wave-front, high-frequency impulses on the line, it is logical that a test giving a voltage of this nature should be applied to them as a part of the initial tests before they are installed on the line. It is interesting to note that tests made on insulators with two different oscillators, one having practically twice the capacity and giving double the voltage of the other, show that there is very little difference in the severity of the tests if the two oscillators are adjusted for approximately the same voltage on a given test, though the frequency of one is approximately 200,000 cycles and that of the other 300,000 cycles.

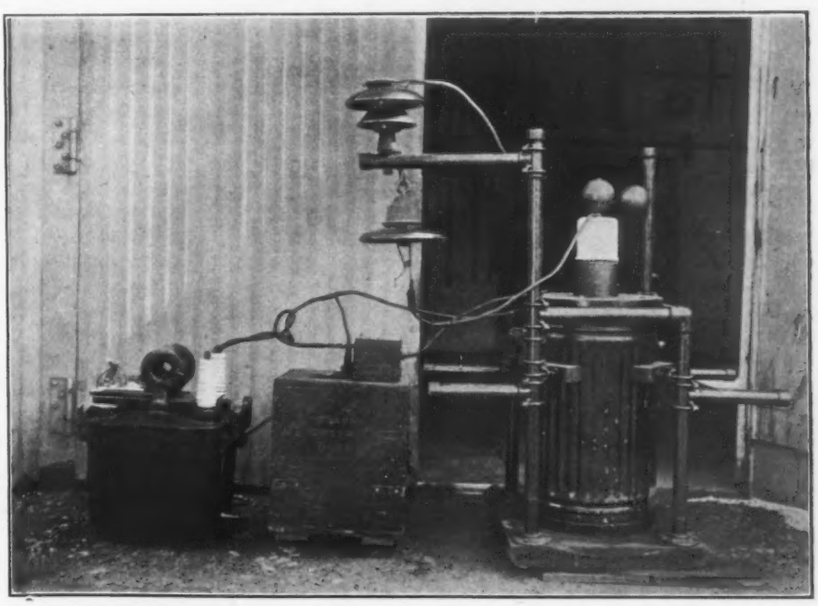


FIG. 4—A PORTABLE OSCILLATION TRANSFORMER TESTING SET

This set is designed to test single units up to 170,000 volts at 300,000 cycles. The three units are arranged so as to be carried on a small truck. At the left is a 110-to-11,000-volt transformer with a 110-volt switch, fuses and choke-coil mounted on the top, in the center a 11,000-volt condenser with a fixed spark-gap, and at the right an oscillation transformer. A pin type and a suspension type of insulator are shown in position for testing.

Locating Leaky Insulators

The writer has found the telephone receiver test which was described in the ELECTRICAL WORLD Oct. 24, 1914, page 821, satisfactory for locating leaky insulators when the line is in service. This test is made by means of a pair of high-resistance telephone receivers connected from a spike driven about shoulder high in the pole to another spike driven in the ground. The noise produced in the telephone receiver gives an excellent indication of the condition of the insulators. It appears from results of this test that its indications are very reliable, and any insulator which is approaching a dangerously weakened condition can be detected. Tests have not been made as yet, however, to determine just the amount of deterioration which may take place in an insulator before the telephone test will indicate trouble.

It is our opinion that the telephone test applied to insulators in service and the oscillator test applied to insulators before being put in service have undoubtedly saved an appreciable number of interruptions.

Portable High-Frequency Test Set Used

A portable high-frequency insulator-testing outfit has been devised by the writer for conducting tests at different points on the system. It consists of an exciting transformer, a condenser and an oscillating transformer arranged as shown in Fig. 4. When in use the exciting transformer is connected to a 110-volt, sixty-cycle circuit capable of furnishing 20 amp. The 11,000-volt auxiliary spark-gap at the top of the condenser is set by gage ¼ in. between sparking terminals. The high-voltage sphere gap has its adjustment fixed and is not changed. The frame of the oscillating transformer is provided with an arm on which is mounted a pin for testing pin-type insulators and a hook for testing suspension insulators. This arm is arranged so that it can be swung out in such a position that when the insulator is in place the high-voltage lead from the center of the transformer clears the framework a sufficient distance to prevent sparking between lead and framework. The high-tension lead is connected by a spring clip to the head of a pin-type insulator or to the pin of a suspension type.

Electricity in the Largest Lumber Mill

Plant of the Weyerhaeuser Company at Everett, Wash., with Its Elaborate System of Motor Drive Electric Conveyors and Transfers, Solenoid Valves, and Battery Locomotives

By A. H. Onstad

THE Weyerhaeuser Lumber Company of Everett, Wash., has recently completed and put into operation what is probably the largest as well as the most modern and completely equipped lumber-manufacturing plant in the world. In this great plant the advantages of electric drive are fully utilized.

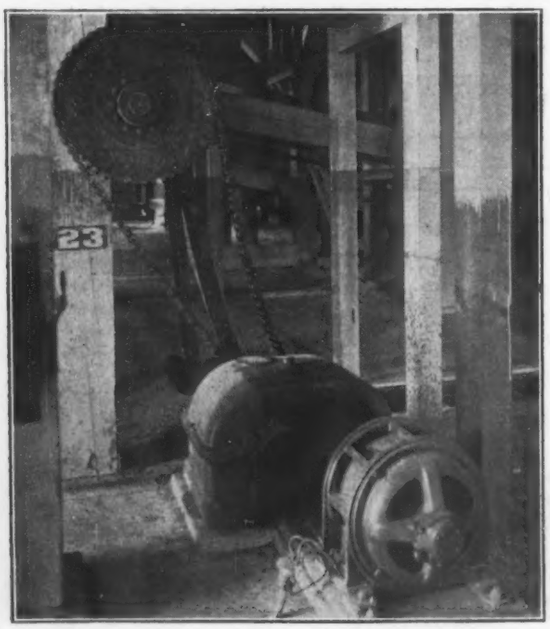
The buildings, comprising sawmill, dry kilns, planing mill, finished-lumber sheds, power plant, fuel-storage house, refuse burner and machine shop, are built on "filled" tidelands on the banks of the Snohomish River where it empties into the Sound. In filling this site electricity played an important part, being the power employed on the dredge used for pumping sand.

The four 495-hp. Stirling boilers are fitted with specially proportioned "Dutch-oven" furnaces, the fuel used being wet sawdust from the sawmill, which is fed to the furnaces from spouts leading from an overhead chain conveyor. When the sawmill is not operating, fuel for the boilers is taken from the fuel-storage house by conveyors and fed to the furnaces in the same way.

The turbine-room equipment consists of one 1000-kw. and one 2000-kw., three-phase, sixty-cycle, 600-volt turbo-generator set operating at a steam pressure of 125 lb. and exhausting into surface condensers; one turbine-driven and one motor-driven exciter set; one 100-kw. motor-generator set, for providing direct current for charging the batteries of the storage-battery locomotives and operating cranes and plunger-type solenoids; one twelve-panel switchboard, and one steam-driven compound air compressor.

The motor equipment of the plant consists of 299 motors, of sizes ranging from 0.5 hp. to 250 hp., and having an aggregate rating of 5051 hp. With the exception of eight direct-current motors, all of the motors are three-phase, sixty-cycle, 550-volt induction motors, operating at speeds varying from 600 to 3600 r.p.m.

Each machine is individually driven, and in some instances the drive for a single machine consists of two or more motors. This arrangement was adopted to secure more flexible control of the driven machine, thereby increasing its output.



CONVEYOR SPEED-REDUCING GEAR—RATIO 25:1

The long lines of rolls and transfer chains are divided into short sections, each section being individually driven. The motors of many of these sections are equipped with remote-control starters, each having several push-button control stations at central and convenient points. This facilitates the routing and transferring of large "cants" and timbers.

For driving the slow-speed sections in this mill speed-reducing power transmissions are used. These consist of a train of herringbone gears and pinions mounted in an oil-tight cast-iron gear case, the high-speed shaft being coupled to the motor by a flexible coupling and the low-speed or driver shaft being either coupled to the driven machine or the connection made by means of steel roller-chain and steel sprockets.

One application of electricity entirely new to the lumber industry is that of employing solenoids for operating the valves on the steam and air cylinders used for raising and lowering the jump saws, trip skids, jump rolls, bumpers, etc. The ease with which the control of a number of scattered operations can be grouped within reach of one operator is a distinct advantage.

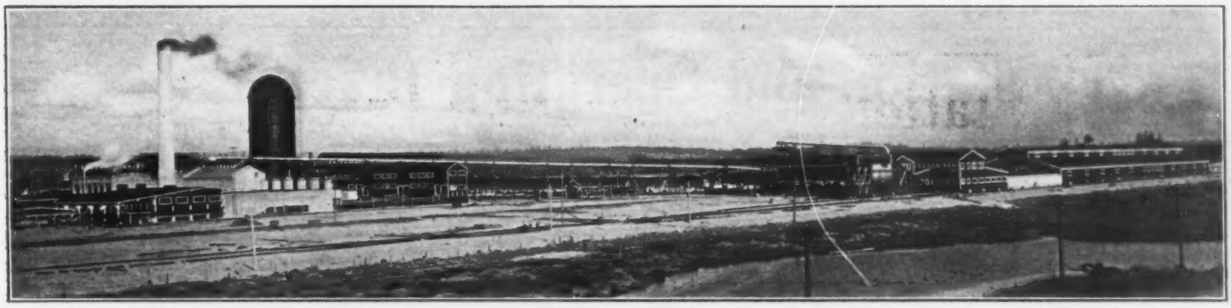
After the lumber leaves the mill it is carried on long transfer or sorting chains. Here the different thicknesses, widths, lengths and grades are pulled off the chains and placed on small industrial cars operating on a 30-in.-gage track. These cars when loaded are pushed onto electric transfer cars which distribute the loads among the storage tracks for assembling into trains.

A 10-ton, 42-ft.-span, high-speed shop-type crane, with specially designed hooks, serves the planing mill. Industrial cars loaded with lumber are left on tracks under and at one end of the crane runway, within reach of the crane hooks. These hooks consist of four L-shaped arms suspended from a structural-steel frame. They are arranged to revolve about the axis of the vertical member of the "L" through an arc of 90 deg. The hooks are interconnected through gearing and driven by a small slow-speed motor, the controller being in the crane operator's cage. With this type of crane hook the crane has an average capacity of thirty loads per hour, the crane operator performing all operations.

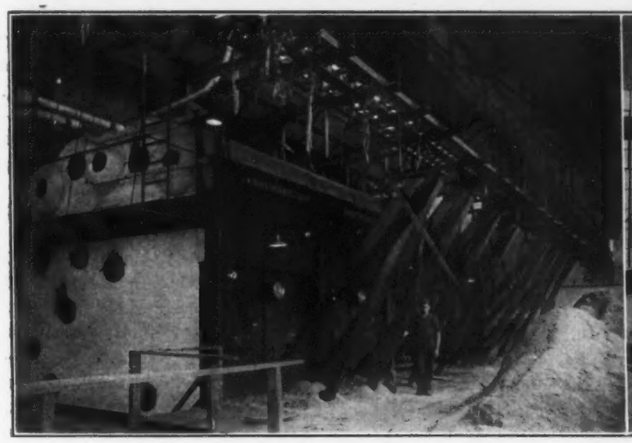
An innovation in planing-mill construction is the installation of motor-driven rolls leading to the front of each machine. These rolls receive the packages of lumber from the crane. The controllers for the motors driving these rolls are so placed that when the machine feeder has placed the last board from one package on the machine he can start the motor and bring another package into place without leaving his position.

Three 7-ton storage-battery locomotives are used for hauling the lumber from the mill to the storage yard and from the yard to the shipping platforms, also for general switching of industrial cars around the plant. Two locomotives can ordinarily do the work, the third locomotive being used for unusually large shipments.

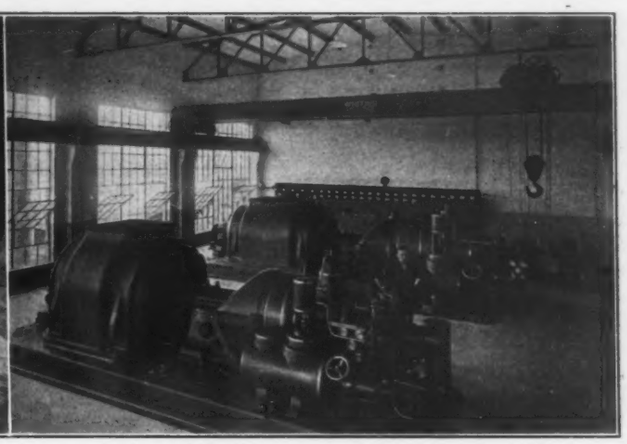
The details of the motor and electrical installation were in charge of the author, as mechanical and electrical engineer for A. B. Pracna, the mill architect who designed the plant.



THE PLANT OF THE WEYERHAEUSER LUMBER COMPANY, EVERETT, WASH., EMPLOYING MOTOR DRIVE THROUGHOUT



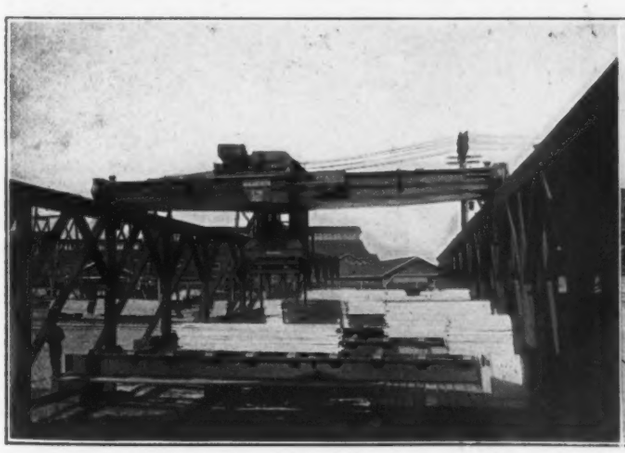
BOILERS BURNING WET SAWDUST AND MILL REFUSE



2000-KW. AND 1000-KW. TURBINE SETS

HANDLING 10-TON LOGS ON THE LOG DECK

BACK-GEARED MOTORS DRIVING "LIVE" ROLLS



TRAVELING CRANE SERVING PLANING MILL

BATTERY LOCOMOTIVE AND TRAIN OF LUMBER CARS

Station and Operating Practice

A Department Devoted to the Problems of Installation, Operation and Maintenance of Equipment for the Economical Generation and Distribution of Electrical Energy for All Uses.

Handling Summer and Winter Loads in a Y. M. C. A.

How a Chief Engineer Has Remodeled Existing Apparatus to Handle Varying Conditions Economically with 100 Kw. of Station Equipment

At the Young Men's Christian Association in Newark, N. J., the peaks of the building and water-heating loads coincide approximately with the maximum electrical load in such a way as to be favorable for the economical generation of electricity. In winter heat and hot-water demands are greatest when residing members return to their rooms at night after business. The electrical load increases about this time also on account of lighting and ventilating the reading and night-class rooms, auditorium and gymnasium. Since lamps are used more hours in winter than in summer, the needed exhaust steam from the generator prime movers is available for longer periods. Although the building is not heated in the summer, large quantities of exhaust steam are needed for heating water for shower baths and the swimming pool, and these are used about the same time the lighting load increases at night. Since more baths are taken in summer than in winter, practically no exhaust steam is wasted during the peak of the electrical loads. The equipment serving this Y. M. C. A. is interesting because most of it has been remodeled to meet lighting and heating requirements.

Layout of Plant Equipment

The entire plant furnishing steam, hot water and electricity occupies a little more than one-quarter of the basement. The generators and boiler auxiliaries are at the front of the building, where fresh cool air can be drawn in through windows opening below the sidewalk level. Adjoining this room is the boiler room, which is adjacent to coal-storage bins under an alley alongside the building. Back of the boilers are other auxiliaries, including water heaters, air compressors and circulating pumps connected with the returns of the vacuum heating system.

Buckwheat coal having a calorific value ranging from 10,000 B.t.u. to 14,000 B.t.u. is delivered to the plant in wagons and stored in a 40-ton bunker under the alley. Another bunker having a capacity of 100 tons is situated under the front sidewalk, but its contents are kept as a reserve supply to tide over shortages which may result from delayed shipments.

Boilers Arranged for Summer and Winter Steaming

Two 100-hp. overhead return-flue Coatesville boilers are employed, one being operated in the summer and the other in the winter. While the units were originally identical, the one which is used in winter has been changed by extending the grate back 1 ft. to accommodate a 48-sq. ft. McClave shaking grate and increase the steaming capacity. The other furnace uses a 6-ft. by 7-ft. Coe dumping grate. Both units have been equipped with economizers, the summer set having one bank of economizer tubes and the winter unit two banks. The arrangement of the double-bank economizer tubes is shown in an accompanying drawing. As indicated therein by the continuous-line arrows, feed water enters on the right, passes through all of the economizer tubes, and thence through the vertical tube to the boiler. In case the economizer gets out of order it can be bypassed and feed water fed directly to the boiler. Surface water in the boiler can be blown off by closing the valves on each side of the vertical pipe and opening the surface blow-off valve.

Inside the boiler used during winter on the end of the feed-water supply pipe is a settling tank and a discharge head which allows the water to drop through the steam space and raises its temperature to practically that of the steam. The settling tank is shown in the cross-section of the boiler. Since the settling tank is

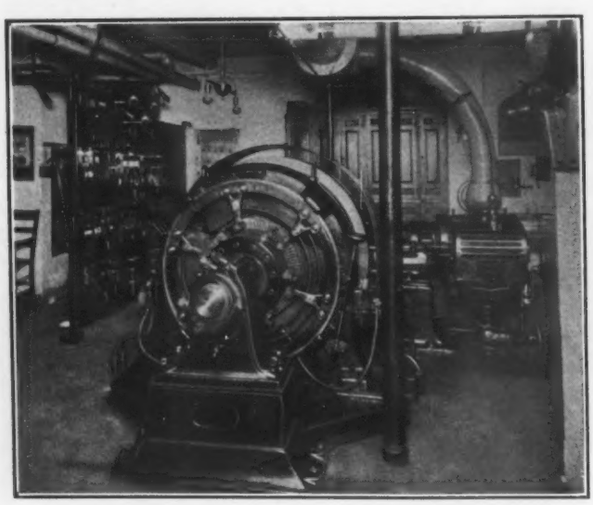


FIG. 1—ONE OF THE 50-KW. GENERATORS DRIVEN BY NON-CONDENSING ENGINE

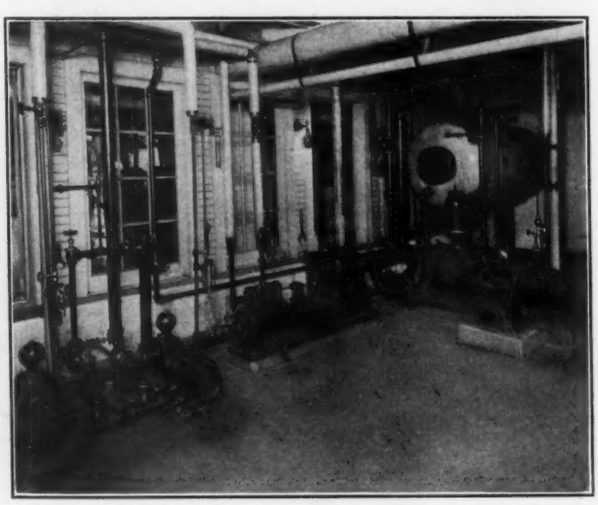


FIG. 2—HOUSE PUMPS, BOILER-FEED PUMPS AND FEED-WATER HEATER

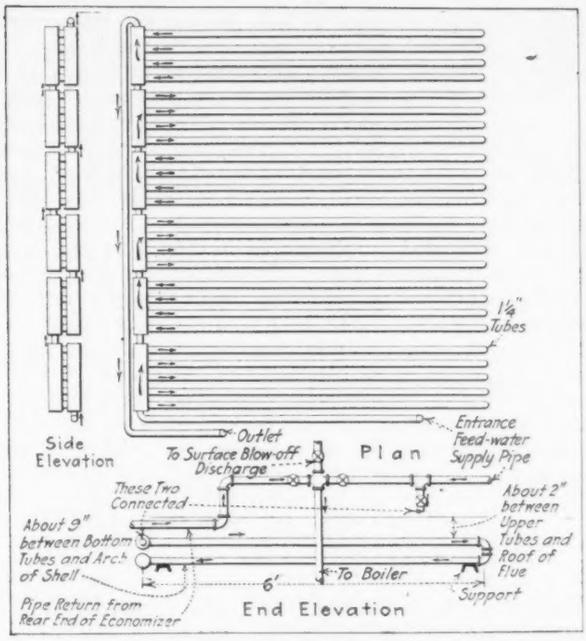


FIG. 3—CONSTRUCTION OF ECONOMIZER USED IN WINTER BOILER AND PATH OF WATER THROUGH PIPING

exposed to boiler temperature, any impurities which may be present in the water are precipitated in the tank, from which they may be blown off periodically through the surface blow-off pipe.

Furnace Conditions

The bottoms of the boiler shells are set 28 in. above the grates and the fuel beds are kept about 3 in. thick. The furnace gases are deflected upward at the rear of the grates by the bridge wall, and a few feet farther back are turned downward by a baffle which causes them to flow through a divided passage and two 2-ft. by 3-ft. arches to a flue leading to the rear entrance of the boiler flues. As the gases emerge from the latter at the front they are deflected upward by a steel plate set in a channel and leaning against a bar set across the front flue. Besides minimizing the eddying of gases, the deflector prevents the finished surface of the large clean-out doors from becoming blistered. Being near the roof of the overhead return flue, the economizer receives the full heat of the gases as they pass on their way to the stack.

The draft has been considerably improved by smoothing the flue surfaces with concrete and sealing the clean-out door openings with firebrick laid with asbestos mortar. Brick laid in this manner can be easily removed when necessary and, besides, protects the doors from intense heat. Sayre & Fisher No. 1 firebrick is used for this purpose and also for the bridge walls and

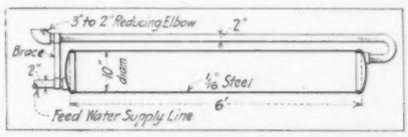


FIG. 5—FEED-WATER SETTLING TANK PLACED INSIDE BOILER BETWEEN ECONOMIZER AND DISCHARGE

baffles. To prevent any acid that may be in the water from corroding the boilers about 60 lb. of zinc is distributed around the inside of each unit just before it is placed in service for six months' operation.

During summer the boilers are blown out once a day, but in winter only twice a week, as very little make-up water is used. While the boilers are licensed for 125-lb. pressure, they are operated at pressure down to 70 lb., depending on the electrical load. A 90-ft. brick chimney serves both boilers, the damper being actuated by a Curtis draft regulator. When the fuel bed is kept even this regulator maintains very constant steam pressure.

Operating Engines at Different Pressures

As exhaust steam is required at all times of the year, simple Harrisburg engines are employed to drive the generators. Two of these engines are directly connected with 120-volt, 50-kw. Western Electric generators operating at 280 r.p.m. The sets are run alternately, each one operating eight hours continuously and resting sixteen hours a day, thus affording sufficient

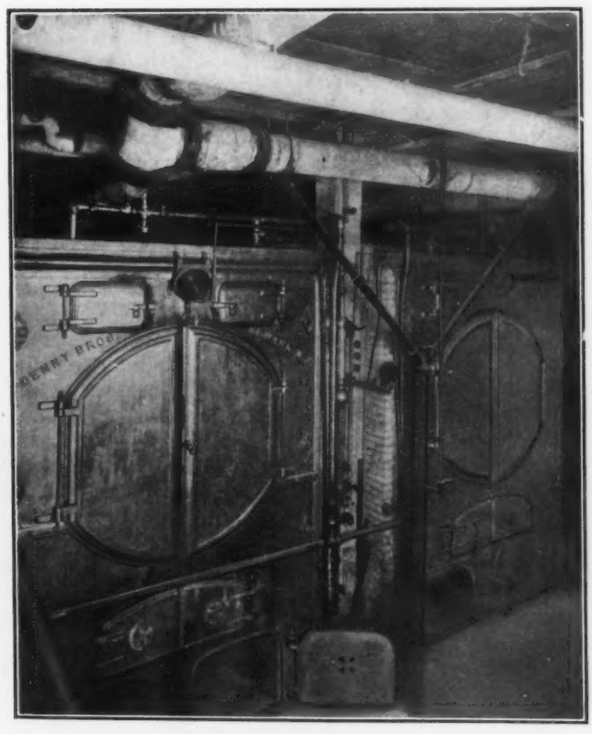


FIG. 4—OVERHEAD-RETURN-FLUE BOILERS

Pipe connections over each boiler are so valved that economizers can be by-passed or sediment in the settling tank discharged through the surface blow-off. The large clean-out doors are protected from overheating by the gas deflector shown in Fig. 6.

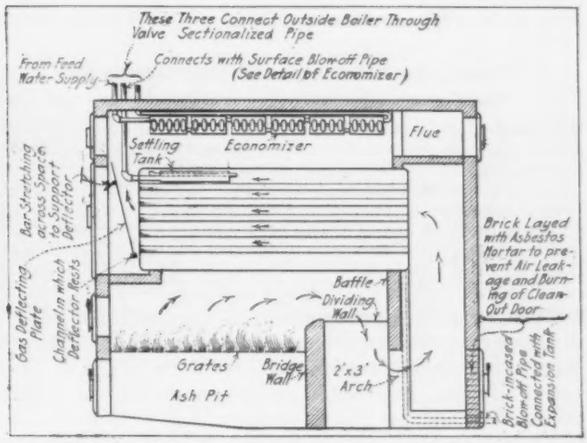

These Three Connect Outside Boiler Through Valve Sectionalized Pipe
From Feed Water Supply
Connects with Surface Blow-off Pipe (See Detail of Economizer)
Flue
Settling Tank
Economizer
Bar Stretching across Space to Support Deflector
Brick Layed with Asbestos Mortar to prevent Air Leakage and Burning of Clean-Out Door
Baffle
Dividing Wall
Gas Deflecting Plate
Channel in which Deflector Rests
Grates
Bridge Wall
2'x3' Arch
Ash Pit
Brick-incased Blow-off Pipe Connected with Expansion Tank

FIG. 6—LONGITUDINAL SECTION OF WINTER BOILER

The principal features of this boiler are the economizers in the overhead-return flue, the settling tank inside the boiler, and the baffles for directing the gases. The clean-out doors are sealed with firebrick laid with asbestos mortar.

time for inspection and repairs. These engines are operated on pressures as high as 115 lb. with extra heavy loads, but since this pressure causes excessive valve wear, produces a loss due to throttling, and increases steam short-circuits, much lower steam pressures are maintained when the electrical load will permit.

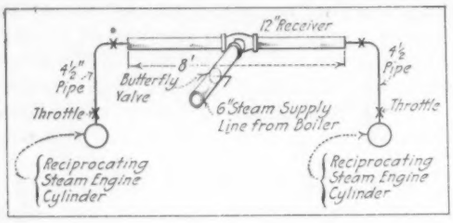


FIG. 7—RECEIVER WITH BRANCHES TO ENGINES

This equipment prevents vibrations due to intermittent demand for steam.

The object of operating the engines at different pressures with different loads is to keep the exhaust pressure as near atmospheric pressure as possible. By so doing the chief engineer believes the best economy is obtained. Of course, the pressure is not changed for every variation in loads but raised in steps, so that at low loads a pressure of 70 lb. is maintained and at full load 115 lb.

Steam is delivered to the main engines through a 6-in. main, but to maintain a uniform flow therein and prevent excessive vibration it is connected by a T with the middle of a 12-in. receiver, which is about 8 ft. long. Leading from each end of this receiver to the nearest engine is a 4.5-in. pipe. A butterfly valve in the steam main is provided so steam can be admitted to the receiver at the proper rate. The auxiliaries are supplied with steam from a separate header tapped onto the boiler header at a lower level than the main steam line.

About the only trouble experienced with the generators is due to dust blowing in through the windows and getting on the commutator. The crank-end bearings are lubricated by oil thrown up from the crank case, while the outboard bearings are oiled with nonmagnetic chains, it being found that steel chains are unsatisfactory owing to magnetism in the shaft. The oil is filtered once a week and used over again.

Descriptions of special equipment to improve this plant's performance and data on the load carried and amounts of coal, oil and waste required annually will appear in a later issue of the ELECTRICAL WORLD.

Interpretations of Data on Steam-Condenser Performance

Formulas and Calculations That Are Convenient for Checking Operation—Comparison of Actual Results with Those of Guarantees

BY H. A. COZZENS, JR.

As long as the vacuum is maintained at a high standard and there is no evidence of leakage of air or of the circulating water, the performance of a surface condenser is usually considered satisfactory. There are, however, many different problems in connection with successful condenser performance in order to detect any decrease in the efficiency of operation and to know when the cleaning and repairing of the condenser are advisable.

The data on which to base computations are easily obtained and consist mainly of temperatures and pressures. Nearly every operating engineer can tell approximately the steam consumption of his turbine or engine, while many others have the facilities for determining the water rate periodically. In order to show some conclusions from test data the following practical case of a large surface condenser will be examined.

TEST RESULTS FROM A LARGE SURFACE CONDENSER

Barometer, inches of mercury	30.62
Steam supplied to condenser in pounds per hour	238,950
Temperature circulating water, in (t_1), in deg. Fahr.	42.20
Temperature circulating water, out (t_2), in deg. Fahr.	56.00
Rise in temperature ($t_2 - t_1$), in deg. Fahr.	13.80
Observed vacuum at top of condenser, inches of mercury	29.54
Temperature of condensate (hot-well) in deg. Fahr.	60.90

First, the vacuum reading is standardized; that is, it is equated to a barometer reading of 30 in. The data give a barometer reading of 30.62 in., or 0.62 in. in excess, which subtracted from the observed reading gives 28.92 in., or the value hereafter used in all computations as the vacuum obtained in the test and referred to a 30-in. barometer. It is easy to remember that when the barometer reading is over 30 in. the excess must be subtracted from the observed reading, and when less than 30 in. the difference must be added.

The efficency of the condenser is expressed as follows: Efficiency = [vacuum obtained] ÷ [vacuum existing at hot-well temperature].

The hot-well temperature is 60.9 deg. Fahr., which gives a vacuum of 29.40 in. The vacuum obtained is 28.92. Substituting these values in the above ratio:

Efficiency = 28.92 ÷ 29.40 = 98.3 per cent.

Some condenser builders are opposed to this method of expressing condenser efficiency because the temperature of the hot-well may vary when the vacuum and injection water temperature is held constant. It is recommended, therefore, that the observed vacuum (before correction) be referred to the barometer reading as a measure of efficiency. This would give

Efficiency = 29.54 ÷ 30.62 = 96.5 per cent.

The amount of circulating water that a condenser uses is a fair indication of its efficiency. For given conditions of vacuum and condenser temperature the heat absorbed by the circulating water must equal the amount of heat given up by the steam, neglecting slight losses, so that a ratio exists between each pound of condensed steam and the circulating water necessary to condense it. This ratio is: [Pounds circulating water per hour] ÷ [pounds steam per hour] = [heat 1 lb. steam above 32 deg. Fahr.] ÷ [rise in temperature of circulating water].

The heat content of the steam, or the B.t.u. content, may be determined in numerous ways. Some use a Mollier diagram, assuming adiabatic expansion in the turbine, following a straight line from the initial to the terminal conditions and obtaining the B.t.u. content at that pressure. Others assume the figure 1000, which in most cases is approximately correct. The heat content may then be computed from the equation

$$\text{Heat content} = H - (t_s - 32),$$

where H is the total heat in 1 lb. of steam at the terminal pressure and t_s is the temperature of the condensate or hot-well.

The temperature of the condensate when not obtained by actual reading may be assumed safely to be 5 deg. greater than the circulating-water discharge. By expressing the foregoing ratio in the terms of a formula we derive: Circulating water, pounds per hour = [pounds steam per hour × heat content] ÷ [rise in temperature]. To express this result in gallons per minute, divide the above by (60 × 8.33), or 500.

The total heat existing at a vacuum of 28.92 in. is 1095.5 B.t.u., from which subtract the temperature of the condensate above 32 deg. Fahr., which results in 1066.6 B.t.u. as the heat content of each pound of steam entering the condenser. This value when used in the formula above for circulating water per hour gives:

$$\text{Circulating water} = \frac{238{,}950 \times 1066.6}{500 \times 13.8}$$

$$= 36{,}940 \text{ gal. per minute,}$$

which is the circulating water required for the condenser in this case.

The heat transfer, or the coefficient of heat transmission, is the rate of heat flow calculated in B.t.u. per square foot of effective condensing surface per hour and per degree of mean temperature difference between the steam and the cooling water. The general law on which heat performance in condensers is based is:

$$H = S \times K \times T_d,$$

where H is the heat rejected by the condenser into the cooling water in B.t.u. per hour, S is the area of the condensing surface in square feet, K is the coefficient of heat transfer, and T_d is the mean temperature difference between the steam and the cooling water.

By transposing, this equation may be written,

$$K = H \div (S \times T_d).$$

This formula is a basic one and must be analyzed to find an equation for each quantity mentioned. H = pounds steam per hour × the heat content. T_d is the thermal head, or

$$T_d = T - \left(\frac{t_1 + t_2}{2}\right),$$

where T is the temperature of the steam corresponding to the vacuum and the quantity in the parenthesis is the arithmetical mean of the injection and discharge water temperatures. Substituting these individual equations in the expression for the heat transfer K, we derive:

$$K = \frac{\text{weight steam} \times \text{heat content}}{\text{surface} \times \left[T - \left(\frac{t_1 + t_2}{2}\right)\right]}.$$

The temperature at the vacuum 28.92 in. is 82 deg. Fahr., and the area of the condenser surface is 25,000 sq. ft., which figure may be obtained from the builder. Applying the test data to this formula,

$$K = \frac{238{,}950 \times 1066.6}{25{,}000 \times \left[82 - \left(\frac{56 + 42.2}{2}\right)\right]} = 310,$$

which is the heat transfer of the condenser.

Another expression for T_d which is used where very accurate work or work of an experimental nature is being carried on is stated below. For all practical purposes, however, the arithmetical mean serves the purpose well.

$$T_d = \frac{t_2 - t_1}{\log_e\left(\frac{T - t_1}{T - t_2}\right)}.$$

It is often of interest to the operating engineer to know whether or not his condenser is meeting the guarantee. Usually none of the points given in the guarantee exactly fits the test conditions, so that the test results must be equated to the conditions of the guarantee. Let us assume that the guarantee approaching nearest our test reads as follows: "For injection water at 50 deg. Fahr. and a steam consumption of 204,000 lb. per hour the condenser will produce a vacuum of 29 in. referred to a 30-in. barometer."

The actual rise in the temperature of the circulating water is 13.8 deg. Then the injection difference is the temperature difference between the guarantee and actual injection temperature, which is (50 — 42.2) = 7.8 deg. Fahr. To get the rise difference, the full-load rise or the equivalent rise when referred to the guarantee steam consumption must be computed, as follows:

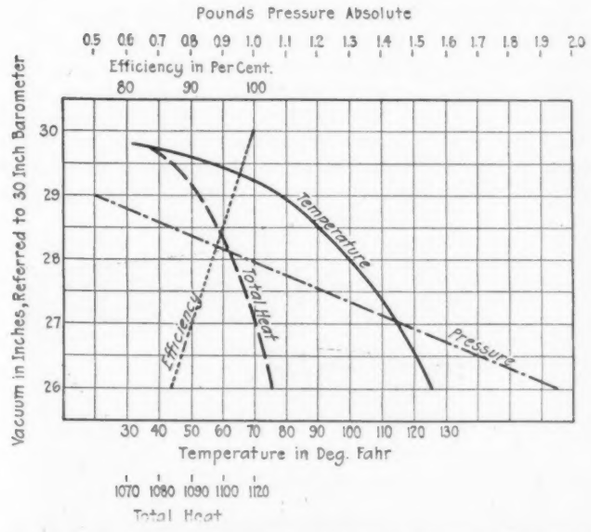
Full-load rise = [guaranteed steam × actual rise] ÷ [actual steam] = [204,000 × 13.8] ÷ 238,950 = 11.8 deg. Fahr. The rise difference is (13.8 — 11.8) = 2 deg. Fahr.

The equivalent vacuum exists at the temperature resulting from the sum of the temperatures of the actual vacuum plus the injection difference plus the rise difference. The signs of these differences are either plus or minus as the actual conditions are above or below those of the guarantee. In the example given the injection-water temperature is below that of the guarantee, making the sign plus, while the actual rise is greater than the full-load rise and the sign is minus. The equivalent temperature is equal to

$$82 + 7.8 - 2 = 87.8 \text{ deg. Fahr.,}$$

and the vacuum corresponding to this temperature is 28.68 in., which is the equivalent vacuum referred to the guarantee conditions. This condenser therefore falls slightly under the required vacuum at this test.

A record of condenser performance can be easily maintained if data be obtained periodically and the performance computed as illustrated above. These results may be plotted as curves, and any abnormal deviation from the preceding curve should serve as the basis for changing the condition of the condenser. It is usually advisable to plot the circulating-water temperatures as well, since allowance must be made during the summer months when the condenser efficiency will obviously be less.



CURVES SHOWING CONDENSER PERFORMANCE AT DIFFERENT VACUUMS

In these curves the relation is shown between the vacuum obtained in a test referred to a 30-in. barometer and the temperature, total heat and absolute pressure in pounds per square inch. The curve denoting efficiency is the ratio of the vacuum referred to the barometer at 30 in. These curves are not intended to supplant steam tables in computations but may be used in rough checks on condenser performance.

Characteristics of Firebrick for Boiler Furnaces

Effect of Furnace Conditions on Firebrick—Considerations in Placing Furnace Settings—Construction of Ignition Arches to Secure Longest Life

By E. H. Tenney*

An item of importance in the maintenance of a boiler plant is the renewal of firebrick. Too often this expense is thought a necessary evil and little effort is made to find the cause of failures or to work out measures whereby the life of brick may be prolonged. When it is considered that 32 per cent of the entire cost of maintenance of the boiler and furnace is in renewals and repairs to brickwork, it is at once apparent that any effort put forth to improve conditions is well worth while.

The modern practice of building boilers of high rating and operating them at very high over-ratings has resulted in excessively high furnace temperatures, calling for the use of refractory materials of such quality as successfully to withstand extreme conditions. The service is such that the very best firebrick obtainable is none too good.

Different Kinds of Firebrick

The firebricks available for boiler-furnace use include "silica brick," "magnesia brick," "chrome brick," "bauxite brick" and "fireclay brick." The value of any of these materials depends upon how they fulfill certain requirements which are essential if the brick is to give satisfactory service. Some of these requirements are infusibility at high temperatures, absence of shrinking or other deformation under operating conditions, strength, resistance to penetration of vapors and slag or to corrosion from contact with substances to which the brick is exposed, and resistance to sudden changes of temperature without spawling.

Silica brick is made from crushed ganister rock with 2 per cent of lime added, in the form of milk of lime, while the stone is being ground. It contains about 96 per cent silicon oxide (SiO_2), which material when highly heated has an affinity for the slag formed in the furnace by the combination of iron and silicon in the coal; hence there is a tendency for this brick to disintegrate rapidly at the sides of the furnace. At certain temperatures the slag fuses strongly with the brick, and the solid mass thus formed can be removed only with more or less damage to the side walls. For this reason silica brick cannot be used to advantage at points in contact with the burning fuel. For strength and resistance to high temperatures this brick measures up to all of the requirements, but it has been found to have one great defect, namely, a tendency to spawl when exposed to rapid changes in temperature. For these reasons silica brick is not considered suitable for boiler service.

Bauxite brick, made from the aluminum ore and silica, contains about 56 per cent of aluminum oxide, 39 per cent of silica, and small percentages of iron and magnesium oxides. The brick is hard and tough and lasts longer than silica brick when exposed to the action of slag, and it is being used to some extent as a high-grade brick. The main objection to its use is its tendency to spawl and fritter away when exposed to drafts of cool air. This brick is also apt to give trouble from shrinkage. The cause for this weakness is inherent in the material inasmuch as the aluminum ore before calcination contains about 30 per cent water of hydration, and unless the burning of the new stock has been carefully and thoroughly accomplished trouble from shrinkage results in the brick. The fact that the higher grades of bauxite ore are in very great demand by the aluminum manufacturers tends to make the price of this material high and puts a premium upon the use of inferior stock. For these reasons bauxite brick has not met with great success in boiler furnaces.

Similarly, magnesia and chrome brick have been found to spawl readily when suddenly cooled or heated, and under high temperature are incapable of withstanding very much pressure. The use of one of these bricks at the fire line, however, has been found a means to overcome very successfully the difficulty from slag.

Fireclay brick is essentially silicate of alumina and is composed of about 54.5 per cent silicon oxide, 40 per cent aluminum oxide, 3 per cent iron oxide, and small percentages of calcium and magnesium oxides and alkalies. Two kinds of clay are used in its manufacture, the hard block or flint clay, which forms the body of the brick, and a soft plastic clay, which acts as a bond and gives the required strength. Fireclay brick is used for boiler-furnace work and gives satisfactory results.

Three grades of fireclay brick may be cited as being available on the market: (1) First-grade firebrick, made up from the best selected flint clay. This brick gives by far the best all-around service for boiler use, standing up without checking under a continuous working temperature of 2700 deg. Fahr. for at least six months. (2) Medium high-grade firebrick made up from the run of flint clay (i.e., not selected) and used for the same purposes as the first-grade brick. Brick of this grade, however, will not stand up and give the service obtainable from the first-grade brick. (3) Ordinary firebrick made up from tempered clay of a grade unsuitable for high furnace temperatures such as obtain in an arch or lining.

Considerations When Placing Settings

While certain information in regard to the physical and chemical qualities of the brick is of value, especially for comparing various grades of brick, certain practical considerations in connection with furnace design, construction and operation have an equally important bearing upon the length of service to be secured from them. One of the most frequent causes of failure in firebrick settings is lack of care in selection of the brick

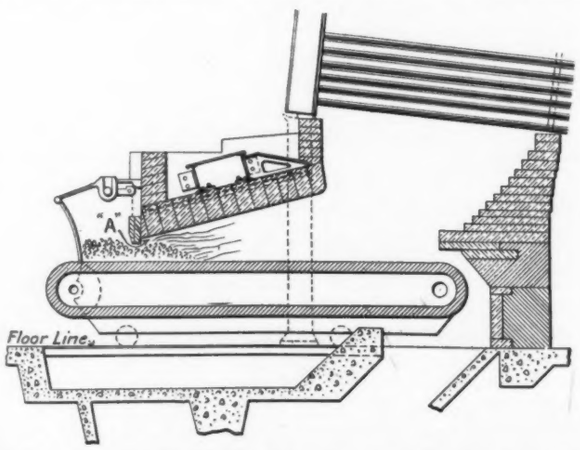


FIG. 1—A METHOD OF SUPPORTING A FLAT INCLINED ARCH TO PREVENT OVERHEATING AND WARPING

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and in placing the setting. Exact uniformity in size of bricks is essential in order that all joints may be true and that there may be no open cracks to fill with fireclay.

The quality of the mortar also has a direct bearing upon the life of the firebrick. Where fireclay of inferior quality is used—that is, with lower heat-resisting qualities than the brick itself—it will tend to fuse within the joint and in so doing cause the side of the brick with which it is in contact to melt, resulting in a shortening of the life of the setting. For this reason the mixing of foreign substances, such as lime or salt, with the fireclay for the purpose of causing fusion should be discouraged. To prevent shrinkage it is customary to mix a certain amount of pulverized brick with the raw clay for the mortar.

Points in Furnace Construction

The length of life of an ignition arch in a boiler furnace of the Dutch-oven type depends to a great extent upon the manner in which the bricks are supported and upon the precautions that are taken in preventing the possibility of their becoming overheated and soft. An exceptionally successful method of supporting a flat inclined arch is shown in Fig. 1. The feature of especial importance is in the strength and rigidity of the supports and in the protection afforded them against overheating and consequent warping. Here the tile at the rear of the arch is supported by cast-iron brackets fitted securely to transverse I-beam supports, which in turn are held by rods extending over the flange of the adjacent I-beam to insure against turning. The forward section is supported by 40-lb. railroad rails bolted directly to the I-beams.

In the case of a sprung arch great care in the proper setting and backing up of the skew-backs is necessary in order that the arch, when hot, may have a sufficiently rigid and true support.

A construction where overheating of firebrick took place is shown in Fig. 2. Here the construction was such as to permit the heat to come in direct contact with the upper as well as the lower side of a portion of the arch brick. In this case the outer portion of the arch softened and sagged, causing a serious restriction of the furnace areas. This weakness was easily rectified by extending a relieving arch the entire length of the main arch, thus protecting the upper side of the brick from direct contact with the hot gases.

Probably every boiler-plant engineer has had the experience of losing an arch through wetting of the firebrick from a leaky tube or some other cause. Firebrick absorbs moisture very readily but dries out slowly, and heat put upon brick imperfectly dried invariably results in disastrous spawling. The spawling of those portions of the brick surfaces which are exposed to the hottest part of the furnace, such as the lower surface of the ignition arch, is, for the most part, due to fusing of the surfaces at those points. These vitrified surfaces are of higher density than the remainder of the brick, and the coefficient of expansion is less. Consequently, on cooling, a strain is set up and a crack started which will result in the breaking off of the vitrified portion.

Similarly, when cold air is allowed to come in contact with hot brick, there is a sudden lowering of the surface temperature and strains are set up which cause the brick to crack and pop off. Where slag and clinker come in contact on side walls fusion readily occurs, owing to the affinity of the silica in the brick for the slag, and a greater or less amount of damage is done when the two are broken apart with the slice bar. In a few recent furnace installations small jets of steam are being introduced along the side walls at the fire line in such a manner as to keep the surface of the brick at a lower temperature than the fuel bed and prevent fusion.

The length of life of the gate tile on chain-grate stokers is influenced to a great extent by the method of operating banked fires. When fires are banked and allowed to stand until they burn back beneath the gate the tile and its supports heat up quickly and suffer serious damage. To avoid such results it is best to clear away the fuel from immediately below the gate during the banking period and permit cool air to circulate past the gate as shown at *A* in Fig. 1.

While it is entirely possible to make certain physical and chemical tests upon different kinds of firebrick and thereby arrive at some idea of their relative value for boiler furnaces, it seems, in the light of investigations made by the United States government and a few large users as well as the manufacturers, that the most satisfactory firebrick for general boiler-furnace use is fireclay brick. For arches, furnace linings and side walls brick made from a selected flint-clay stock should be specified.

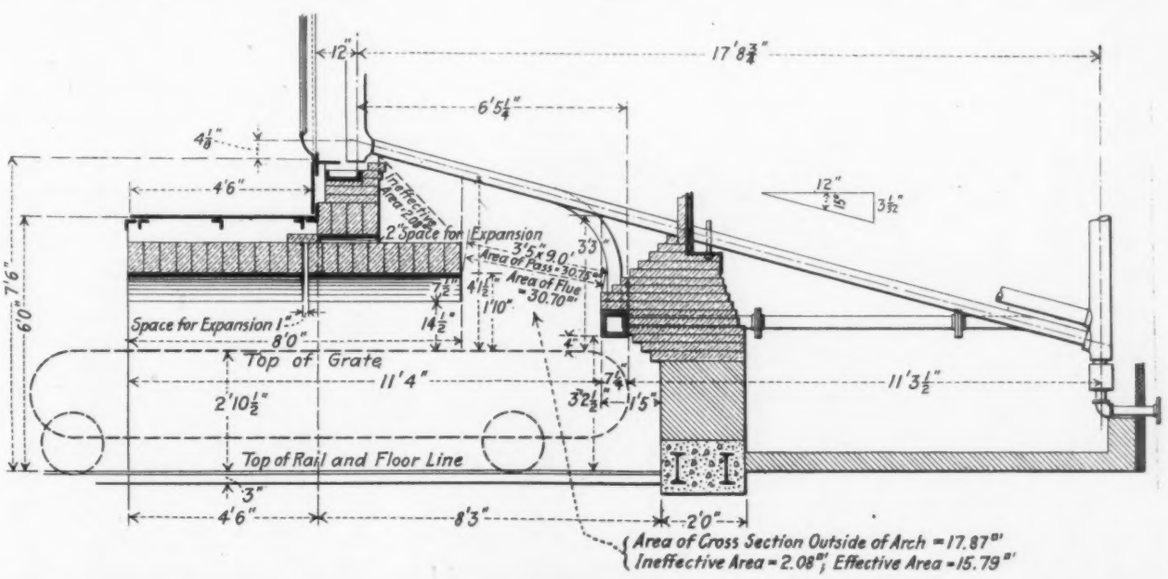


FIG. 2—A CONSTRUCTION WHERE OVERHEATING OF FIREBRICK TOOK PLACE AND SAGGING OF ARCH RESTRICTED FURNACE AREA

GROUNDED-SECONDARY SYSTEMS

Effect of Ground Connection When Trouble Develops, and How Protection Is Secured

The experiences of central stations that may be considered typical when operating a grounded secondary distribution system have been compiled by the committee on transmission and distribution of electrical energy of the Ohio Electric Light Association and seem to show that transformer insulation is sufficiently reliable to stand any additional strain that may be caused by grounding the secondary and that the ground connection affords a certain measure of protection against abnormal potential rise on secondary distribution systems. The action of the ground wire under the following conditions was reported:

Normal Ungrounded Primary Systems

One Wire Crossed with Secondary.—In the case of an ungrounded system of primary distribution, if a cross occurs between a primary wire and a secondary wire that is grounded, the only duty imposed on the secondary ground connection is to carry off the leakage and charging current of the primary system from which it feeds. The greater the territory served from one primary system the larger will be the current flow when one wire is grounded. Extensive systems of distribution will normally pass several amperes when any wire is connected to ground and the potential of such systems is fixed quite steadily at the neutral voltage above ground potential.

In the case of a 2300-volt single-phase system this neutral potential is 1150 volts, and 1325 volts for a three-phase system. It is thus seen that as long as the other primary wires are clear of grounds the current flow is limited to a small value and the resistance of a secondary ground connection may be fairly high and still afford protection against potential rises on the secondary in the event of primary cross.

Normal Grounded Primary System

One Wire Crossed with Secondary.—When one primary wire of a grounded system becomes crossed with a grounded secondary disposition, the full line potential is applied directly to the secondary grounded connection, and if the current flow is not great enough to trip out the feeder, the full primary potential will appear from the secondary wires to the ground.

TABLE I—RESISTANCE OF DIFFERENT TYPES OF GROUND CONNECTIONS

No.	Description	Ohms
1	10 lb. scrap copper set 6 ft. deep, surrounded by 10 lb. coke	14.2
2	Copper plate, 5 ft. by 3½ ft., set 4 ft. deep, surrounded by 2 ft. crushed coke	5.6
3	One 9-ft. length 1¼-in. black iron pipe driven 6 ft. in solid earth	25.1
4	One 9-ft. length 1¼-in. galvanized-iron pipe driven 6 ft. in solid earth	24.5
5	One 12-ft. length 1¼-in. black iron pipe driven 9 ft. in solid earth	14.8
6	One 12-ft. length 1¼-in. galvanized-iron pipe driven 9 ft. in solid earth	18.4
7	Two 9-ft. lengths ¾-in. galvanized-iron pipe set 6 ft. deep and coke tamped around pipes	15.2
	One 9-ft. length 1¼-in. galvanized-iron pipe set 6 ft. deep and coke tamped around pipe	26.7
9	Perforated metal cone 18 in. long, filled with charcoal, buried 6 ft. in 2 ft. of coke	14.4
10	Patented type of driven ground pipe	19.5
11	Patented type of set ground connection	11.7
12	Connection to city water system at faucet placed about 100 ft. from test grounds	00.44

One Wire Crossed with Secondary, Another Wire Grounded.—A normally ungrounded primary system may have some other wire accidentally grounded at the time a cross occurs between primary and secondary. In this case full-line potential is applied to the two paths to ground in series, and instead of only having the leakage and charging current to carry off, the secondary ground may receive any potential from zero up to full-line voltage, according to the relative resistance of the ground on the other primary wire and that on the secondary. Under these conditions the secondary ground wire might carry a large amount of current and its resistance would have to be very low to prevent a serious potential rise on the secondary system.

The data in Table I give the resistance of various ground connections under similar conditions. The results were secured from a number of types of ground connections installed at 10-ft. intervals. After allowing these to settle for a period of three months, measurements were taken every three months for a period of eighteen months over a wide range of temperature and moisture conditions. The resistance of any one type varied very little under any weather conditions, the maximum variation of any reading being 35 per cent of the average value.

TABLE II—CURRENT FLOW IN GROUND CONNECTIONS GIVEN IN TABLE I AT VARIOUS VOLTAGES

No.	Amperes			
	115 Volts	1150 Volts	1325 Volts	2300 Volts
1	8.1	81	94	162
2	20.5	205	237	410
3	4.6	46	53	92
4	4.7	47	54	94
5	7.8	78	90	156
6	6.3	63	72	125
7	7.6	76	88	152
8	4.3	43	50	86
9	8.0	80	93	160
10	5.9	59	68	118
11	9.8	98	113	196
12	261.0	2610	3000	5220

Where the only duty of the ground connection is to carry off leakage and charging current, any of the ground connections mentioned in the table will protect a secondary distribution system in event of a primary cross.

In case full primary voltage is applied when one primary wire is crossed with a secondary, the only protection of the ground is to carry enough current to trip the feeder circuit-breaker. This depends upon the automatic setting. For a 2300-volt breaker set to trip at 100 amp., all of the ground connections except Nos. 3, 4 and 8 of the table will trip the feeder breaker. If there were two ground connections in parallel on the secondary distribution of the No. 3, No. 4 or No. 8 type, this arrangement would trip the feeder breaker, and in the case of a breaker set for 200 amp. only the water system connection or the copper plate would be affected.

In the case of a normally ungrounded primary system with one wire crossed with a secondary and another wire grounded, the current flow might be of any value from zero up to those shown in Table II for 2300 volts, according to the resistance of the accidental ground on the wire other than that assumed to be crossed with the distribution. In this case only a small amount of current could flow before a potential rise would occur on the secondary. The water-system connection, however, would pass 261 amp. before the secondary potential could rise above 115 volts.

The conclusions drawn from these data are that secondary distribution systems should be grounded to water systems wherever possible, and where it is not possible to reach the water system at least two, and preferably more, artificial ground connections should be used at each secondary grounding point.

A LARGE STEEL-MILL MOTOR DRIVE

Features That Governed Selection of a 1600-Hp. Geared Motor and Arrangements for Its Control

At the steel plant of the Atlanta (Ga.) Steel Company a 1600-hp. induction motor operates through a geared connection a 14-in. six-stand continuous billet mill having a rating of 30 tons per hour when rolling billets 1 in. to 2 in. square from metal 4 in. in size. In selecting this type of motor drive several engineering features were considered—first, the flywheel effect of the rotor of the motor to absorb at its operating speed the shocks due to sudden overloads in the operation of the mill; second, the cost of a directly connected drive as against a geared drive, and, third, the use of a "breaking spindle" to prevent possibility of wrecking the machine because of overload. The problem resolved itself finally into the use of a directly connected motor operating at 72 r.p.m. or a geared drive operating at 257 r.p.m. The rating of the motor required was 1600 hp., and the power available was three-phase, sixty-cycle, at 2200 volts, from the transmission lines of the Georgia Railway and Power Company. After a consideration of first costs, efficiency and power-factor, the geared outfit was selected, using a herringbone gear set consisting of a cut forged-steel pinion and a cut cast-steel gear with the necessary housing, bearings and bed-plate. These gears are placed in an oil-tight steel casing and operate submerged in the oil without noise. The gear ratio is 5.5 to 1. The set was furnished by the Falk Manufacturing Company of Milwaukee, Wis.

The first cost of this geared drive as compared with the directly connected arrangement was about equal. The efficiency and power-factor of the higher-speed motor was several per cent more than the slow-speed directly connected motor, however, and for this reason the geared outfit was chosen.

In the final arrangement of the drive adopted the 14-in. shaft of the General Electric motor was connected to a 4.5-in. "breaking spindle" through a flexible coupling just outside the outboard bearing of the motor. This spindle is connected to the pinion of the herringbone gear through a second coupling. The "breaking spindle" is designed to fail at 4000 hp., and since the motor will carry a momentary overload in excess of this amount for from two to three seconds, the arrangement offers a safe protection for the motor. The motor itself is designed to carry a 75 per cent overload for five minutes and a 25 per cent overload for two hours.

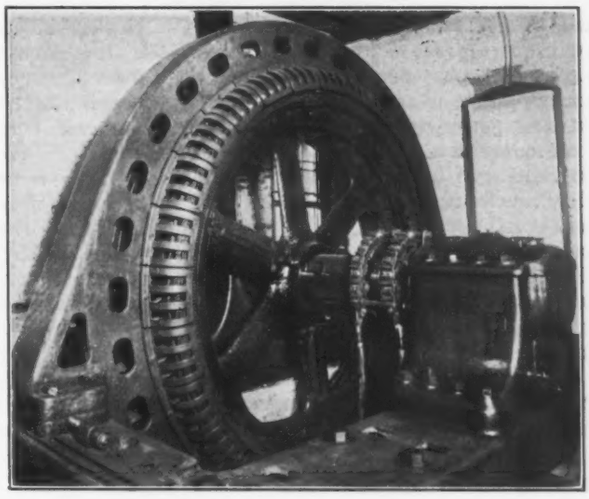


FIG. 1—A 1600-HP., 257 R.P.M. INDUCTION MOTOR GEARED TO BILLET MILL IN PLANT OF ATLANTA (GA.) STEEL COMPANY

The operating features of this large drive are interesting first on account of the control arrangements and emergency features. The control is based upon the use of General Electric automatic magnet-contactor panels with current-limit acceleration which provides for stopping in emergency cases by reversal of phase. The control apparatus and the panel construction, shown in Fig. 2, consist of seven contactor panels, one relay panel and one starting panel. To start the motor the main oil switch is closed, which throws full-line voltage (2200 volts) on the stator, with all resistance in the form-wound secondary. A master controller arrangement is provided which may be used for hand-controlled acceleration if desirable. However, the motor is usually operated on automatic current-limit acceleration by setting the master controller on the full-running position and closing one of the primary oil switches. The cur-

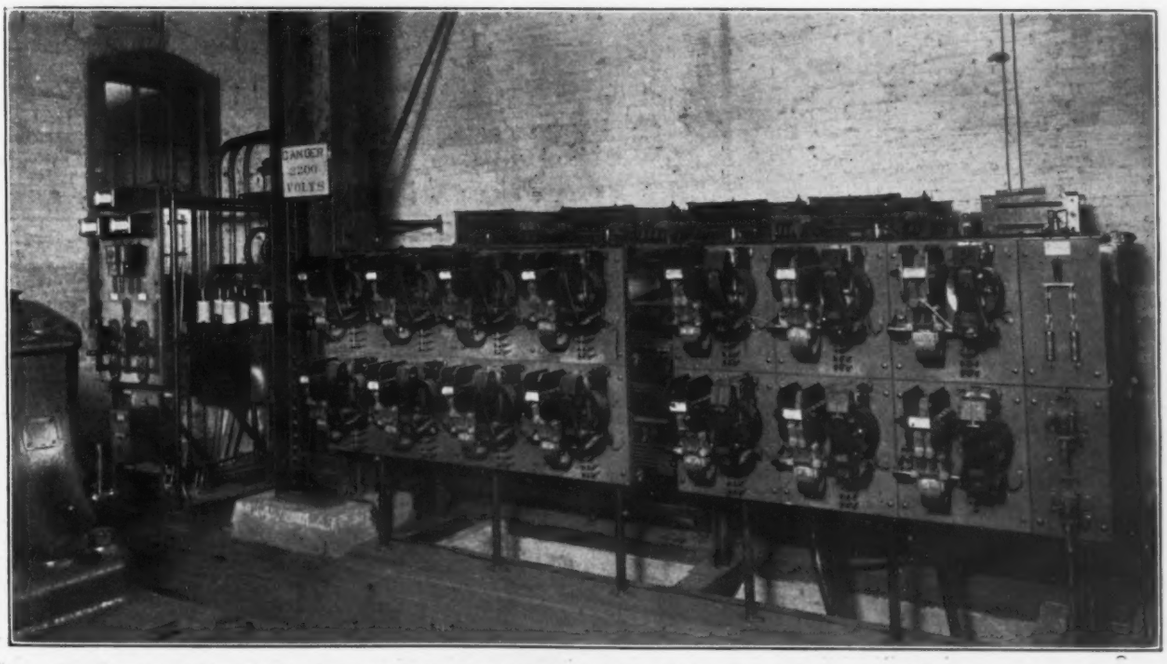


FIG. 2—AUTOMATIC MAGNET-CONTACTOR CONTROL PANELS FOR OPERATION OF A 1600-HP. MOTOR DRIVE

rent-limit relays permit the successive closing of the current contactors at such times as the line current drops to a predetermined value for the preceding contactor. The usual setting of such devices limits the current peaks during acceleration to 25 per cent overload current. An interlocking system, together with current-limit relays, prevents either too fast or too slow acceleration of the motor. This large motor drive has been in operation about two years and has proved satisfactory. It has also solved a power-plant problem since the company's station equipment was loaded to its full rating when the drive was installed. The increase in energy demand has thus been made possible without increasing the steam generating station.

Three 500-kw. transformers are installed in the structure housing the motor drive and step down the voltage from 11,000 to 2200 for motor operation.

Making a Place for a Substation in a Factory Building

In a Massachusetts factory a convenient and compact substation arrangement has been secured by building a one-story structure between two "L's," as shown in the accompanying illustration. In this way space of no productive value inside the plant proper was utilized, providing a fireproof and safe lay-out for the transformer and oil-switch equipment. Heavy wired-glass windows and ventilators were installed, and provision was made for the ingress of fresh air near the ground as shown in three square duct openings protected with netting. An outer door was also provided in addition to the usual interior door, thus facilitating safe egress in case of trouble and also making the equipment more accessible in emergencies. The feeders are brought into the station overhead with drip loops and the usual porcelain bushings at the entrance. There are places about nearly every factory building where advantage can be taken of inexpensive yet well-protected construction, and in many cases this arrangement will save copper and duplication of wall-entrance provisions as compared with the construction of a special structure.

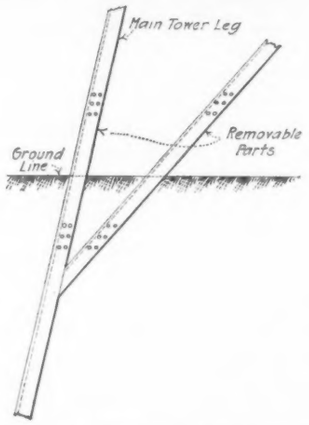
AN ISOLATED SUBSTATION STRUCTURE YET A PART OF THE FACTORY BUILDING

Operating Schemes

Two dollars will be paid for each item published giving ideas and data, new or simplified methods and experiences in solving troubles.

A Plan to Defeat Rust on Legs of Transmission-Line Towers

Each tower in a new transmission line between Prairie du Sac and Madison, Wis., is provided with renewable legs. Those portions of the legs most likely to be attacked by rust—the sections at the ground line—have been made renewable so that any weak member may be



RENEWABLE PARTS FOR TOWER LEGS AT GROUND LINE

replaced. Under normal conditions any square-base tower will stand on three legs, so that to substitute new pieces in place of rusted ones the maintenance crew has only to unbolt the old ones, remove them, and put in duplicate members.

A Scheme for Securing 50 R.p.m. from a 220-Volt, 250-R.p.m. Direct-Current Motor

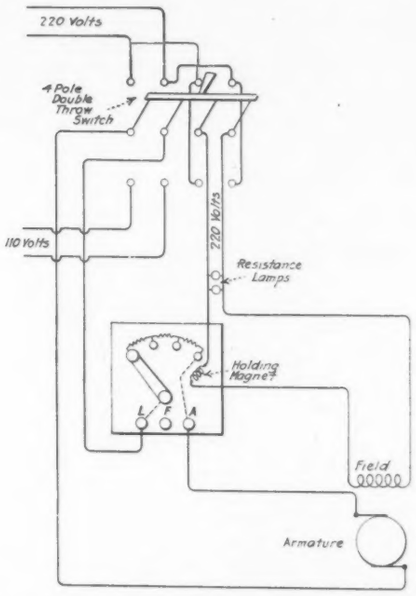
By V. A. Clarke

The accompanying illustration shows a scheme for securing a speed of not more than 50 r.p.m from a 220-volt, 2.5-hp. shunt-wound direct-current motor built to operate at 250 r.m.p. The motor could be slowed down somewhat by cutting down the voltage by resistance, but the loss through heating of the resistance was considerable and it was impossible to approach the desired speed. The motor was next tried on 110-volt supply, but with this the speed regulation was poor. It was finally decided to operate the field at 220 volts, thereby assuring good regulation, and to connect the armature to the 110-volt line through sufficient resistance to give the desired speed.

Several difficulties of a mechanical nature were involved. Provision had to be made for opening the armature circuit if by accident or design the field switch were opened, otherwise the motor would run away. It was also advisable that an opening of the armature circuit should open the field circuit. If the field of a 220-volt motor is thrown off too suddenly, high-voltage oscillating currents are momentarily produced, which may be high enough to puncture the insulation.

The apparatus used consists of nothing more than a regular starting rheostat and a four-pole, double-throw switch. The 220-volt current comes in on one throw

of the switch and 110-volt on the other, so that the motor can be run at any desired speed. The left-hand middle terminals of the switch are connected one to the "line" lead of the starting box and the other to one side of the motor armature. The other side of the motor armature is connected to the "arm" lead of the rheostat. The upper and lower right-hand terminals



FIELD AND ARMATURE CIRCUIT CONNECTIONS FOR REDUCING THE SPEED OF A DIRECT-CURRENT MOTOR TO 50 R.P.M.

of the switch are connected together and to the 220-volt line. The middle right-hand terminals are connected to the shunt field of the motor through the holding magnet of the starting box, so that 220-volt current is supplied to the field no matter which position the handle is in. Two lamps are placed as shown across this line so as to afford a resistance to the high-voltage oscillation mentioned above when the circuit is suddenly broken. If now the field current is suddenly opened, the holding magnet releases the arm on the starting box and the armature circuit is automatically opened. When the motor is to be stopped entirely the handle of the switch must be in the middle position. It may be interesting to know that by connecting a 6-volt storage battery to the armature a speed of 5 r.p.m. was obtained.

A Method of Sealing Transformer Cases and Preventing Siphoning of Oil

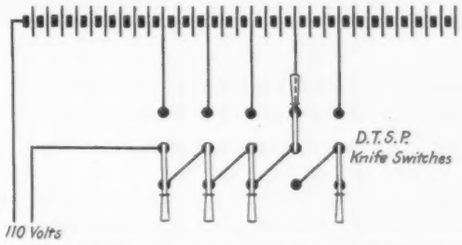
BY A. C. HEWITT

It is often necessary to seal up holes in transformer or oil-switch cases where wires pass through. Probably the most commonly used material for this purpose is a mixture of sulphur and plaster of paris. Either material used by itself may answer the purpose in some cases, but if the two are mixed half and half it gives a very hard substance, when it has set, and one that is impervious to transformer oil. The sulphur should be melted in a ladle or pot and then an equal quantity of plaster of paris mixed thoroughly into it. This mixture should be poured into place while hot.

Trouble is often experienced from oil being siphoned out of transformer cases on account of the braided insulation on the lead wires. When this takes place it is usually found that the insulation on the wires dips down into the oil. If the oil level is lowered below the terminal board inside the case and the insulation on the leads scraped off so that where the wire enters the surface of the oil its metallic surface only is exposed to possible contact with the oil and the leads are properly sealed, there will be little trouble due to siphon action.

A Simple Battery Switching Scheme for Operating Oil Circuit-Breakers

The switching scheme shown in the accompanying diagram is used in a power station where a 110-volt direct-current control circuit is needed for operating oil circuit-breakers. For this purpose a 275-cell power storage battery was available, the proper voltage being obtained by tapping off the required number of cells.

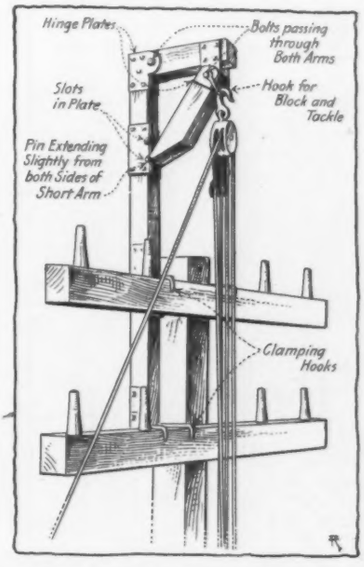


KNIFE SWITCHES WIRED FOR ADDING END CELLS TO BATTERY

To take care of the changes in the voltage of the battery at different times of the day, taps were taken from five cells. The connections for changing from tap to tap are shown in the diagram, five single-pole, double-throw switches being used. The arrangement is practically foolproof, as it is impossible to short-circuit any of the cells in changing from one tap to another.

Portable Derrick for Handling Transformers

Portable collapsible derricks, like that shown in the accompanying illustrations, are being used by the Edison Electric Illuminating Company of Boston for hoisting transformers into position on poles. Similar ones are employed for swinging transformers aboard trucks and lowering them into manholes. The derrick illustrated herewith consists of three wooden members forming a brace from which a block and tackle can be sus-

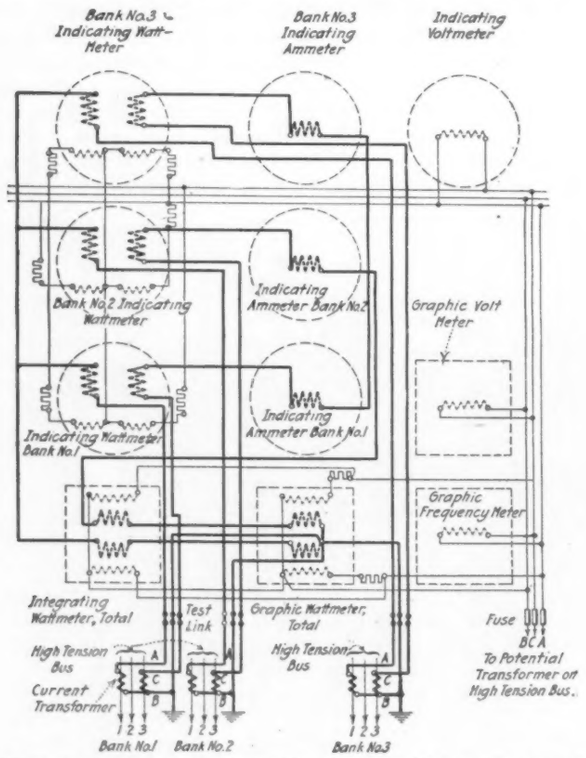

Hinge Plates
Bolts passing through Both Arms
Slots in Plate
Hook for Block and Tackle
Pin Extending Slightly from both Sides of Short Arm
Clamping Hooks

ARRANGEMENTS FOR RAISING A POLE TRANSFORMER

pended. Between the inclined arm and the horizontal piece and between the latter and the upright member are special hinges, the construction of which is clearly shown in the cut. Attached to the free end of the inclined arm, and projecting slightly from each side of it, is a metal pin which engages with either of two pairs of inclined slots in the steel plates attached to the upright. These connections permit the folding of the derrick when not in use. At the base of the upright and at a point equal to the distance between cross-arms above it are steel supporting and clamping bolts shaped to fit over the cross-arms and hold the derrick firmly in an upright position. The upper hook is threaded on one end so that it may be used to clamp the upright and cross-arm securely together. This equipment is capable of lifting transformers weighing 500 lb. It was developed by B. A. Pond, of the Boston company.

Instrument Transformers Arranged to Serve Separate-Circuit and Totalizing Meters

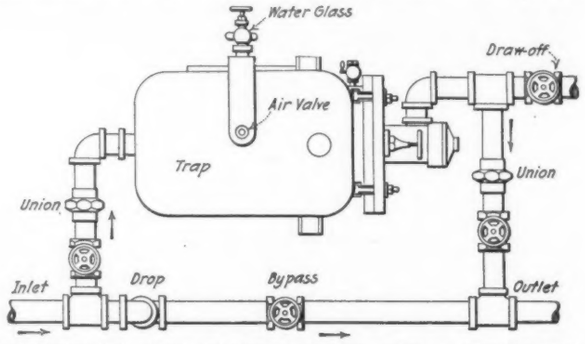
At the American Manufacturing Company's plant, Brooklyn, the indicating wattmeters and ammeters on each bank of transformers are so connected with the totalizing watt-hour meter and graphic wattmeter that no totalizing current transformers are required. As shown in the accompanying diagram, current transformers are connected with two legs of each transformer bank, and corresponding terminals of each instrument transformer are joined with a common ground wire. One terminal of each pair connects with a series circuit including one coil of its respective indicating wattmeter, integrating watt-hour meter and graphic wattmeter, and then with the ground. The remaining terminal of each pair connects with another series circuit including the other current coil of its respective indicating wattmeter, indicating ammeter, integrating watt-hour meter and graphic wattmeter, and then with the ground. These connections require joining one terminal of each ammeter and one current coil of each indicating wattmeter with separate common busbars leading to the totalizing instruments. The connections are shown in the accompanying diagram.



CONNECTIONS OF INDICATING AND INTEGRATING METERS TO MINIMIZE CURRENT TRANSFORMERS REQUIRED

A Convenient Arrangement of Steam-Trap Connections

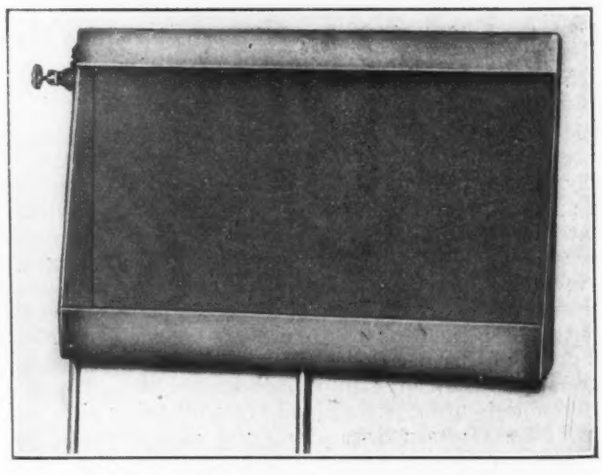
A layout of connections for steam traps in which the water of condensation is separated from the steam and allowed to flow by gravity or forced by the pressure of steam to a receiver is shown in the accompanying diagram. This arrangement includes a water glass, an air valve, a draw-off, and necessary unions for readily disconnecting the steam trap, together with proper valve connections for the flow of steam through or around the trap when the latter is cut off for repairs. Where the local conditions permit, the trap should be installed in the straight run of the main line, all fittings for turns being made in the by-pass, as this is seldom used.



CONNECTIONS AND VALVE CONTROL FOR A STEAM TRAP

A Handy Blueprint Washer That Requires Little Space

To facilitate washing blueprints at the Greenfield (Mass.) office of the Turners Falls Power & Electric Company, the engineering department has constructed the apparatus shown in the accompanying illustration. It consists of a copper pan 7 ft. long, 2 ft. 9 in. deep, and with top and bottom horizontal widths of 5 in. and 7 in. respectively, mounted against the drafting-room wall about 3 ft. above the floor. Water is supplied through a ¾-in. pipe and controlled by a valve shown at the upper left-hand corner. A horizontal pipe run

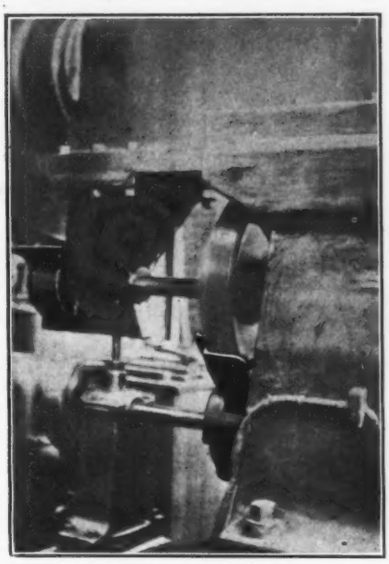


A TANK FOR WASHING BLUEPRINTS WHICH IS MOUNTED ON THE WALL

across the top with numerous perforations enables a blueprint to be flooded quickly when backed against the inside of the pan, and a plug and drain pipe at the bottom permits the waste water to run off.

Emphasizing Danger Points on Tools and Making Wiring Safe

The use of gear guards is as old as the safety movement, but some shops go a step further and paint the danger points a bright red. The accompanying photograph was taken in a large Eastern plant and shows a heavy motor-driven punch provided with a metal guard 0.25 in. thick around the region where the gearing meshes. The sharp contrast of colors in the danger zone due to the dull finish of the machine frame and the



GEAR GUARDS ARE PAINTED RED TO INDICATE DANGER ZONE

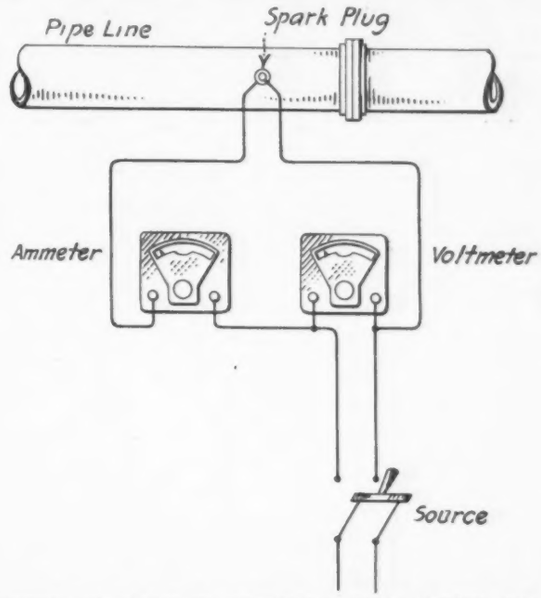
red paint warns the workman effectively. On this tool a tendency toward better wiring is seen in the use of conduit and a special outlet fitting at a point subjected to vibration.

A Scheme to Detect Salt-Water Leakage in Surface Condensers

When salt water is used for circulating purposes in connection with surface condensers there is always the possibility of contaminating the condensate because of leakage of the condenser tubes or packing. This leakage is usually detected by titration, which consists of making chemical tests of the condensate, using nitrate of silver as the reagent. These chemical analyses are influenced to some extent by the ability of the operator and when performed as routine by the oiler or engineer are not made with the care that can reasonably be expected. To those operating men who have experienced difficulty in this respect the following electrical method of determining leakage of tubes may be of interest:

This scheme has as its basis the measurement of the potential drop in a circuit. Referring to the illustration, an ordinary spark plug is screwed into the condensate pipe as near the base or hot-well of the condenser as possible. Across the two leads to this spark plug a voltmeter is connected, and an ammeter is placed in the circuit as shown. Assuming no leakage, pure water will flow across the gap of the spark plug and offer a high resistance to the flow of the current. This condition results in a high potential drop across the gap. As leakage occurs the resistance decreases and the drop becomes less also, affecting the flow of current.

By a little experimentation the resistance of various states of the water from pure to rank contamination

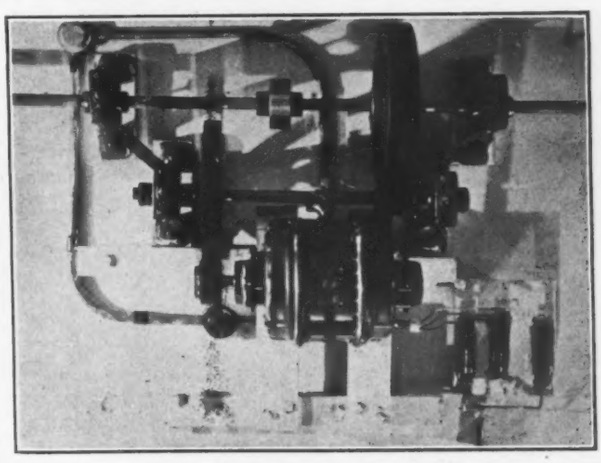


CIRCUITS TO MEASURE POTENTIAL DROP ACROSS GAP OF SPARK PLUG AND THUS SHOW STATE OF CONDENSATE

may be computed by Ohm's law and the results recorded. In actual operation the oiler may read the instruments and record the data on his log sheets. When these are turned in it requires but a few minutes' work to determine the condition of the condenser as regards leakage.

A Convenient Location for a Motor Drive in a Basement

A compact motor-drive arrangement is shown in the accompanying illustration as installed at the Worcester (Mass.) market in a basement passageway below a conveyor shaft. The motor drives a package conveyor through double-reduction gearing and the mechanism is bolted to wooden blocking on the concrete ceiling of the basement. Diagonal iron straps are used between two of the adjacent bearing caps, as shown at the left, to stiffen the structure and facilitate alignment. The motor is fed from a circuit run in conduit.



ARRANGEMENTS FOR SUPPORTING AND CONTROLLING MOTOR ON BASEMENT CEILING

Marketing Electricity

A Department on Selling Service and Widening the Use of Electrical Energy

A Jobbing Policy with "Service" as the Watchword

The Ample Stocks and Elaborate Office Methods Behind a St. Paul (Minn.) House's Slogan of Service to the Customer

SERVICE and quality are the passwords at the door of success in the electrical jobbing business, declares J. M. Hannaford, Jr., who is manager of sales for the Northwestern Electrical Equipment Company of St. Paul, Minn. On those two points—efficient service to the trade and high quality in the goods handled—the jobber is judged most critically by his customers. The present business of the Northwestern company has been built on a service and quality foundation, and the stability of the resulting structure prompts these statements.

Any jobber with a good sales force can "sell a customer once," but the jobber who supplies service with each sale will get the future business, and that is the business any jobber or merchant wants. Therefore the men of each department of the company are urged to work with these two ideas—service and quality—uppermost in mind. Perhaps the best way to show how service is rendered the customers is to tell what happens when an inquiry comes to the company's home office.

Suppose, for instance, that a request for information is received from a prospective customer who wants to install an electric-light plant in his town. The original inquiry is first sent to the engineering department for its recommendations, and a copy is forwarded to the sales department for "follow-up" purposes. A copy of this "follow-up" notice is also dispatched to the traveling salesman from whose territory the inquiry came. Copies of all important correspondence with the customers of each road salesman are, in fact, sent to the salesman at the close of each business day. These salesmen co-

THE CITY SALESROOM WITH DEMONSTRATING ROOM ADJOINING

operate with the home office in its plans and call upon important prospective customers as soon as possible after inquiries are received.

The salesman tries, of course, to influence the customer to purchase from the Northwestern company, and as one of his strong talking points emphasizes the benefit to the customer from using the company's plan of electrical development in his town. This plan of development is, as the salesman tells the customer, placed

GENERAL OFFICES OF THE NORTHWESTERN ELECTRICAL EQUIPMENT COMPANY, ST. PAUL, MINN.

THE KEEPING OF AMPLE RESERVE STOCKS IS PART OF THE NORTHWESTERN COMPANY'S POLICY OF PREPAREDNESS

in operation as soon as the plant starts work. Circular letters under the plant's name exploiting electric service are prepared and mailed to all prospective users of electricity in the town. Articles on the use of electricity, particularly in "white-way" and street lighting, are prepared for the local press. Later, illustrated letters, mailed again under the plant's name, are sent to all of the residence customers of the electric company, pointing out the advantages in the use of tungsten lamps, heating appliances and vacuum cleaners. Special letters on the proper lighting for window displays, showcases and store interiors are sent to shopkeepers at the same time. In all of these letters the recipient is told that the goods mentioned may be obtained from the local electric company and that these goods are guaranteed by both the local company and the Northwestern Electrical Equipment Company.

This same service is also offered the electrical contractor and dealer in towns where the central station is not engaged in the merchandising business. A further letter service on the advantages of house wiring has been prepared for such customers. A calendar and Christmas-booklet service is offered once a year to all classes of the trade who care to avail themselves of it. The company also publishes a bright and breezy little house organ, known as the *Northwestern Buzzer*, which it sends to its customers monthly.

These sales helps are not given free to any customer. On the circular and illustrated letters the customer pays the cost of addressing the envelopes and the postage. Calendars are purchased in large quantities and sold to the customer at actual cost. Christmas booklets are sold at actual cost. Where possible all advertising is mailed directly to the ultimate consumer, thus insuring a return on the investment in advertising distributed.

In addition to aiding the dealer in developing his territory and educating his customers, the Northwestern company keeps all of its customers supplied with information regarding new electrical devices which it has for sale. In the files all customers' names are listed by States and classified by occupations, and as new material of interest to some division of industry is put on the market, information regarding the new device, including its price, is sent to those likely to be interested.

Other information regarding each individual customer's business is also kept on file to aid the sales department in correctly filling orders when the desired product is incompletely described. For instance, if a mail order for a small motor is received and the customer has forgotten to specify at what frequency the motor will operate, it is only necessary to refer to the data blank to determine the proper number of cycles per second. The motor can then be shipped at once.

To give further speed in shipping service the new building occupied by the Northwestern Electric Equipment Company has been designed with every facility for rapid business. Two large freight elevators and a passenger elevator connect all floors. A gravity chute runs from each stock floor to the shipping room, and forty-six intercommunicating telephones connect all departments. Demonstrating rooms, showrooms and rest rooms for both customers and employees are maintained on the office floor. With the recent addition to the general office building, a total of 120,000 sq. ft. of floor space is now occupied by the company.

The officers of the Northwestern Electric Equipment Company are: F. B. Thompson, president and treasurer; J. M. Whalen, vice-president; A. J. Anderson, secretary and manager; J. M. Hannaford, Jr., manager of sales, and E. A. Oas, credit manager.

Harmonizing the Portable Lamp with Its Surroundings

At the Toy Town Tavern, Winchendon, Mass., the attractiveness of the living-room is much enhanced by the electric-lighting installation, which was planned to harmonize with the surroundings, the latter being of Colonial design, with wicker furniture. The central feature is a portable lamp mounted in a wicker standard, 10 in. in diameter at its base and carrying its shade edge 14 in. above the table. The shade is 18 in. in diameter and is provided with a filling of cretonne upon the wicker framing.

CRETONNE SHADES HARMONIZE WITH ROOM

The lamp shade matches the wallpaper, and the screening of the lamps insures entire absence of glare. Since the cretonne is only moderately translucent, the beauty of the resulting illumination is unusual. This instance illustrates what an important part utility and decoration combined may play in rendering a hotel living-room homelike and attractive, going far toward creating a real "atmosphere" at a moderate expenditure of energy.

In the same hotel a rustic playhouse used for dancing, concerts, etc., is effectively illuminated by hanging a number of drums from the rafters, removing the

usual sheepskin heads and mounting a 25-watt lamp inside each drum, the heads being composed of ground-glass disks. Here, again, fitness of fixtures to the decorations and purpose of the room is brought into play. Electric-heating devices are also used in the tea-room kitchen of the playhouse.

Letting the People Know About Their Street Lighting

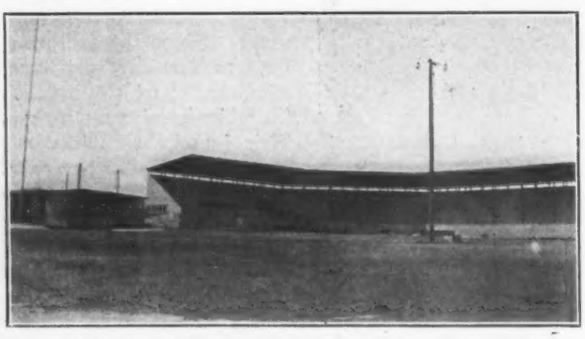
Display lighting of the so-called "white-way" type would seem to require little external publicity, but on the recent inauguration of a system of this kind at Lowell, Mass., the local central station made effective use of the city dailies to tell the public some of the essential points bearing upon the new work.

Thus, in one advertisement, covering an entire page, the company pointed out that local labor was employed throughout in the construction of the system. The dates of beginning and ending work under the contract with the city were given, with some particulars as to the selection of lamps and poles and the amount of cable, conduit and new power-station equipment needed. The attention of the public was called to the engineering excellence of the installation, which, while not the most extensive system in the country, is noteworthy for its perfect continuity and scientific light distribution. The success of ornamental luminous-arc lighting elsewhere was touched upon and the part played by the company in the work was clearly set before the people at large. A signed letter from Mr. Edison to the Mayor of the city, congratulating the latter upon the installation, was exhibited in the lighting company's office window.

A Baseball Park That's Busy All the Year

Winter's advent closes the baseball park and drives the "fans" indoors, and the land on which these amusement centers are built becomes unproductive for more than half of each year. Electrically speaking, a ball park's load-factor is therefore less than 50 per cent. At Dubuque, Iowa, however, the Municipal Athletic Field, as the ball park is called, is as busy a place in mid-winter as it is on a hot summer Saturday afternoon, because a public-spirited citizen, Eugene Adams, has enlisted the aid of electricity to turn the field into a winter skating rink to help keep the park land working nearly all the year around.

To accomplish his purpose, Mr. Adams had a small earth dam built around the outer edges of the infield. Then with a spray of water the workmen coated the entire field with ice. The earth dam prevented any of the water from running away through the lower portions of the outfield and made the ice field level. At the same time that the ice was being made by the workmen in co-operation with the cold weather another crew was installing a high center pole carrying 750-watt and 1000-watt gas-filled tungsten lamps in 12-in. diffusing globes. Later the grand stand and a newly erected 40-ft. by 60-ft. warming house were wired for lighting and a 0.5-hp. motor was installed for sharpening skates. With this work completed the ball park represented to the central station a total connected load of about 4 kw. To the people of Dubuque the altered ball park became a safe, convenient and well-kept ice-skating rink. The admission fee charged to spectators and skaters alike was 10 cents, and the net proceeds of the venture were applied to help wipe out a debt of about $3,000 which was still outstanding against the park.

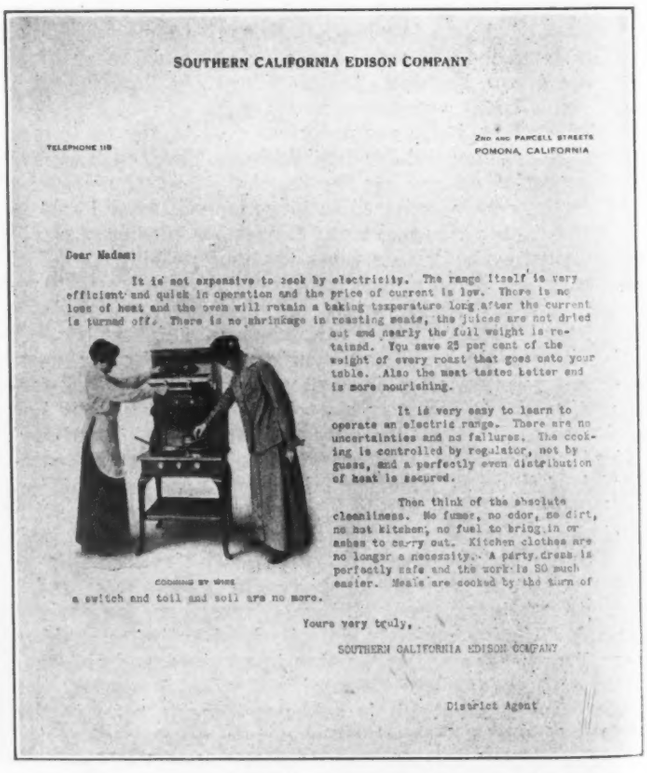


THIS BALL PARK BECOMES A SKATING RINK IN WINTER

Southern California Edison Company Opens Campaign on Electric Ranges

The Southern California Edison Company opened on Nov. 1 a special campaign on electric ranges, the purpose of this immediate campaign being to sell ranges to residences in territory not already served with gas. An initial group of 530 ranges will, it is estimated, add a load of 210 kw., replacing the noon sag in the load curve with a peak.

Plans were worked out at a meeting of the men in the commercial department in Los Angeles Oct. 28, when the matter was presented by S. M. Kennedy, general agent, and discussed by the men who will have charge of the campaign in the field. The company will do the installing of the ranges itself, practically at cost. Energy for lighting and cooking will be measured by one meter. The rate will provide for the first 40 kw.-hr. at the present lighting rate, 7 cents per kilowatt-hour, and energy in excess thereof at 3.5 cents per kilowatt-hour, it being made an express condition, however, that the electric range be installed and used for cooking. The minimum will be $2.50 instead of $1, as for lighting. The average cost per connection for installing the range is estimated at $30.



SOUTHERN CALIFORNIA EDISON COMPANY

TELEPHONE 119

2ND AND PARCELL STREETS
POMONA, CALIFORNIA

Dear Madam:

It is not expensive to cook by electricity. The range itself is very efficient and quick in operation and the price of current is low. There is no loss of heat and the oven will retain a baking temperature long after the current is turned off. There is no shrinkage in roasting meats, the juices are not dried out and nearly the full weight is retained. You save 25 per cent of the weight of every roast that goes onto your table. Also the meat tastes better and is more nourishing.

It is very easy to learn to operate an electric range. There are no uncertainties and no failures. The cooking is controlled by regulator, not by guess, and a perfectly even distribution of heat is secured.

Then think of the absolute cleanliness. No fumes, no odor, no dirt, no hot kitchen; no fuel to bring in or ashes to carry out. Kitchen clothes are no longer a necessity. A party dress is perfectly safe and the work is so much easier. Meals are cooked by the turn of a switch and toil and soil are no more.

COOKING BY WIRE

Yours very truly,

SOUTHERN CALIFORNIA EDISON COMPANY

District Agent

SAMPLE LETTER MAILED TO PROSPECTIVE RANGE USER

Window Suggestions for Thanksgiving and Electrical Prosperity Week

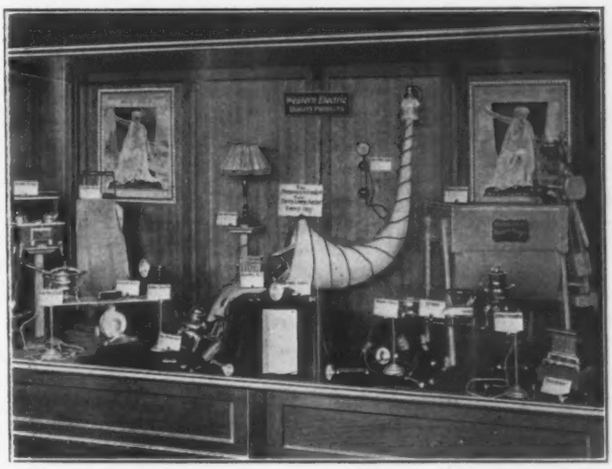
TAME WHITE MICE, RABBITS OR TURKEYS WILL ADD TO THE HUMAN INTEREST OF THIS TASTEFUL THANKSGIVING DAY DISPLAY

A TABLE SET WITH SUCH AN ELECTRICAL THANKSGIVING DINNER AS THIS CANNOT LACK IN APPEAL TO EVERY PASSER-BY

Big opportunities for getting sales results from electrical window displays are at hand, points out A. J. Edgell of the Society for Electrical Development, Inc., who is president of the International Association of Display Men. The immense amount of newspaper, class-journal, moving-picture and other publicity which Electrical Prosperity Week has received has focused the attention of the public on everything electrical. Never has the dealer had more incentive to make displays. His store is in the spot-light.

Nearly every buyer looks first in the show window these days and will pay particular attention to electrical windows, because the idea of electric service appeals to everyone, and the rapid increase in its applications is still a marvel to the public. The dealer who has a display that is attractive and possesses "selling punch" is bound to "cash in."

About a week before Thanksgiving Day, which falls on Nov. 25 this year, a display suitable for the occasion should be made. Immediately after Thanksgiving Day a strong Electrical Prosperity Week display should be the feature, and this may also reflect the holiday spirit to encourage early Christmas shopping. Care should be taken to avoid anything freakish in the display. The objective, it must be remembered, is to sell merchandise.



"TAP PROSPERITY AND COMFORT FROM EVERY LAMP SOCKET EVERY DAY" READS THE PLACARD WHICH SOUNDS THIS EXHIBIT'S KEYNOTE

WHERE SPECIAL HOUSEWIRING OFFERS ARE MADE DURING PROSPERITY WEEK, THIS WINDOW ADDS THE FINAL ARGUMENT OF USEFULNESS

CHRISTMAS BUYING DURING ELECTRICAL PROSPERITY WEEK MAKES THE ELECTRICAL DEALER A LEADER IN THE "DO-YOUR-SHOPPING-EARLY" MOVEMENT

Successful Policies That Promote Beneficial Relations Between Central Stations and Contractors

The adoption by central stations of more uniform working rules governing installations, and the giving of information to contractors in cases of special inquiry without disclosing the "prospects" of one contractor to his competitors, were recommended by the committee on relations between contractors and central stations in its report presented to the recent convention of the New England Section of the N. E. L. A. Walter H. Mulligan, Springfield, Mass., who headed the committee, also suggested that central stations prepare a list of unwired and partly wired "prospects" in their districts, such lists to be open to the contractors for canvassing.

The committee advocated that when central stations are conducting house-wiring campaigns conferences should be held with reputable contractors of the vicinity relative to the establishment of prices and methods of work sufficiently remunerative to warrant the support of regularly established contractors, the latter rendering the fullest possible support to the campaigns. In connection with contracts financed by the central station, prices and terms should be settled solely between the contractor and the customer with reference to additional wiring or appliance sales, the amount being subject to the approval of the central station if the addition is to be financed by the latter.

Exchange of Credit Information

Co-operation was urged with reference to furnishing to contractors information relative to the credit standing of customers. When contractors secure new business, which means a larger expense for line extension than central stations feel warranted in making for a particular customer, it is recommended that the stations make immediate and active canvass of the neighborhood in conjunction with the contractors, to secure enough additional business to warrant the cost of the line extension. Another recommendation was the formation of a permanent arbitration committee of four members, two from the central stations, two from the contractors, and a fifth to be selected by these four, for the consideration of matters of joint interest.

In the discussion which followed the report Fred H. Smith, Worcester (Mass.) Electric Light Company, said that until the contractor demonstrates his ability to handle the electric appliance business the central stations will have to continue in it. J. A. Hunnewell, Lowell (Mass.) Electric Light Corporation, described conference meetings between his company and local contractors at which complaints are frankly discussed and points of friction eliminated as far as possible. Agreement cannot as yet be reached relative to the sale of lamps, but the company endeavors to distribute work among the contractors as fairly as possible. The company recognizes the contractor who has an established place of business in the business part of Lowell, a telephone and someone in attendance during business hours.

Price Maintenance and Profit Protection

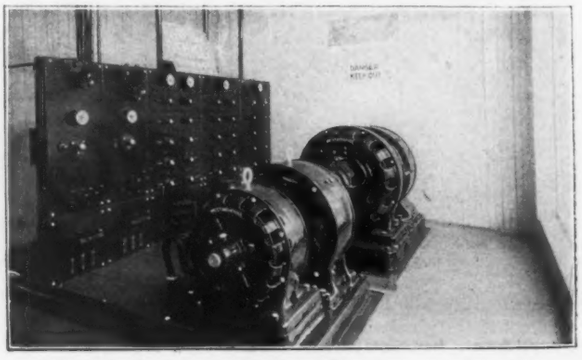
E. R. Davenport of the Narragansett Electric Lighting Company, Providence, R. I., said that his company does not believe in free lamp renewals, and that it is selling 200,000 lamps at list prices this year. Proper relations with contractors demand that the profits of the latter shall not be "trimmed" by the central station. Even the office and private wiring of the Narragansett company is done by contractors. C. R. Hayes, Fitchburg, Mass., said that in local meetings with contractors only present-day problems are discussed. He did not think the central station should specially recompense the contractor for developing "prospects." Mr. Smith pointed out that the Worcester company is wiring about 100 old houses a month on a schedule of prices made by the contractors. At the end of the year a prorated check is sent to each contractor, covering the difference between his bids and the schedule, less 5 per cent for the cost of handling by the electric company.

Electric-Service Companies Co-operate in Exhibit at Oregon State Fair

Recognizing the opportunity afforded at State fairs for interesting farmers and ranchers in the use of electrical apparatus, some twelve Oregon electric-service companies this fall co-operated in exhibiting various energy-consuming devices and applications of motors at the recent Oregon State Fair. The display, which was housed in a large tent, included groups of motor-driven farm and dairy machines, irrigation pumps, domestic appliances and electric ranges. The household appliances were exhibited in an attractive booth constructed to resemble a bungalow. On one day more than 6000 persons visited the show.

A Novel Window Trim for an Electric Garage

The electric garage sells few accessories, and it is therefore difficult to dress its windows as attractively as those of a gasoline-car garage. One Chicago electric-garage manager, W. C. Hateley, instead of displaying in his windows an array of the few accessories available, has placed his rectifying equipment in one window and his office in the other. The rectifying equipment consists of two motor-generator sets and a control board, connected to the mains of the Commonwealth Edison Company. The display requires no retrimming and when kept scrupulously neat and orderly, as at this garage, is said to be of considerable advertising value.



THE ROYAL GARAGE, CHICAGO, WHICH FEATURES MOTOR-GENERATOR CHARGING SETS AND OFFICE AS WINDOW DISPLAYS

Technical Advance in Theory and Practice

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

AN ARC WITH UNCONSUMED ELECTRODES

Some Interesting and Promising Experiments on the Electric Arc in Vapors and Gases of Certain Chemical Salts at Reduced Pressures Between Solid Tungsten Electrodes

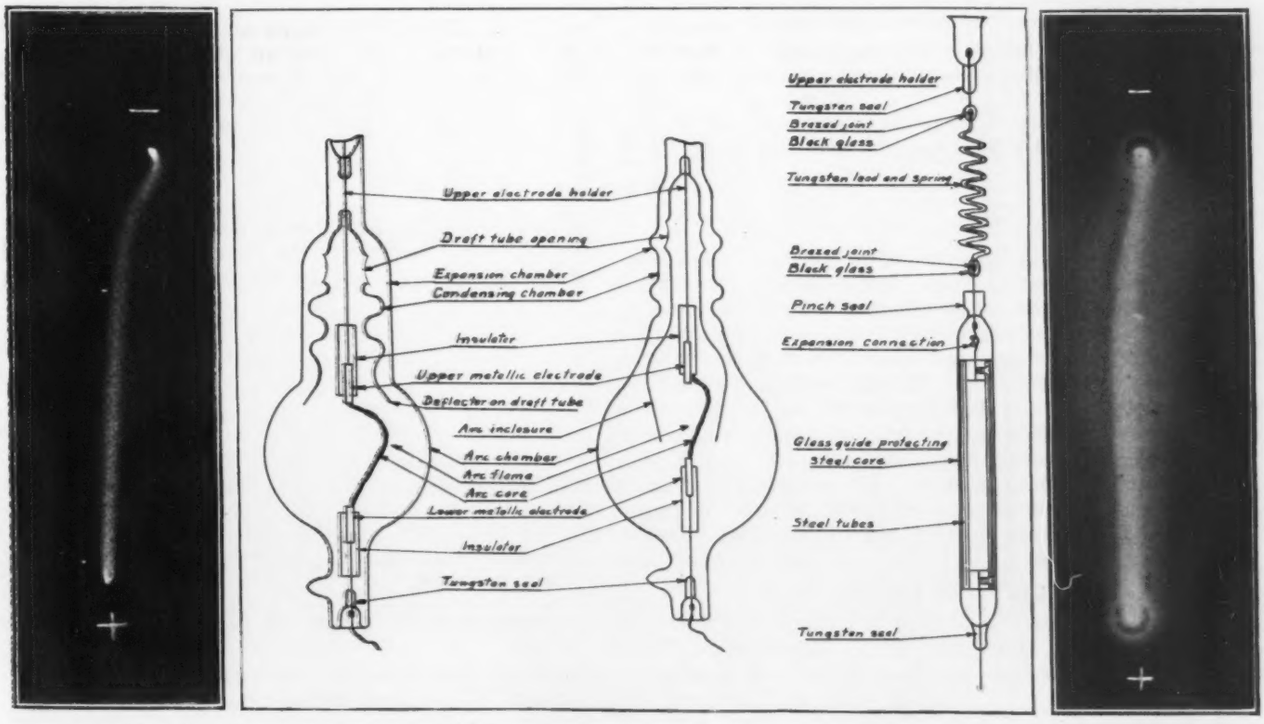
The success of the ductile tungsten lamp has so far extended the scope of incandescent lighting and has made such distinct inroads into the field formerly occupied by the arc lamp that prophets have not been found wanting to declare that the arc lamp is doomed. Yet the arc lamp is in the hands of its friends. Very interesting possibilities were brought out in a paper presented by W. A. Darrah at the joint meeting of the New York Section of the American Electrochemical Society and the Illuminating Engineering Society on Nov. 11.

Mr. Darrah pointed out that present commercial arc lamps operate with few exceptions in an atmosphere rich in oxygen or the oxide compounds of the electrodes. As a result the electrodes are oxidized as rapidly as they are vaporized (if not already composed of oxides as in the case of a magnetite arc), and as the oxides cannot be used again commercially it is necessary to provide means for disposing of them. This cycle of vaporization and oxidation of the electrodes naturally results in their comparatively rapid consumption, which necessitates the trimming and cleaning of the arc lamp —one of the large factors of arc-lamp operation.

If it were possible so to design the lamp that the supply of material for the arc did not come from the electrodes but from a surrounding gas or vapor, and if in passing through the arc the vapor were not destroyed, it would then seem to be possible to construct an arc lamp which would not require trimming or materially more attention than an incandescent lamp. A lamp of this type, if it produced white light and good efficiency, might in some cases even occupy the field of the present incandescent lamp. The research which is described in Mr. Darrah's paper was carried on to investigate the possibilities of accomplishing this object, and while the results are very promising from a practical standpoint, they were outlined by the author for their scientific value and should be considered only in the light of scientific research.

A study of the light efficiency of an arc from a chemical standpoint shows that there is a certain rather limited class of substances which when introduced into the arc in small quantities produce a very great increase in luminosity. Thus the addition of small quantities of cerium or calcium compounds to the carbon arc may increase its efficiency over 300 per cent, and the addition of titanium (preferably as an oxide) to the magnetite arc similarly produces an increased luminosity without a corresponding increase in energy consumption. But it is a peculiar coincidence that the addition of cerium or calcium to the magnetite arc, or of titanium to the carbon arc, does not result in approximately the same gain in efficiency. The chemical compound in which the element appears is apparently of little importance.

A study of these facts led to the conception that perhaps an arc could be maintained in a closed vessel and supplied with these light-producing elements in the vapor form. The arrangement of the apparatus is shown in Fig. 2, which shows the latest designs. The



FIGS. 1, 2 AND 3—ARRANGEMENT OF APPARATUS USED, AND TYPICAL ARCS BETWEEN UNCONSUMED TUNGSTEN ELECTRODES IN VAPORS OF LUMINIFEROUS SALTS AT REDUCED PRESSURES

lamp consists essentially of an arc chamber at the center of which the arc is drawn between two tungsten electrodes about 3/16 in. in diameter. The electrodes are partly surrounded with a refractory insulator, designed to prevent the arc from moving far from the ends of the electrodes. Tungsten was found to be the most satisfactory electrode material, as it is practically inert, even at a white heat, in the presence of various vapors used.

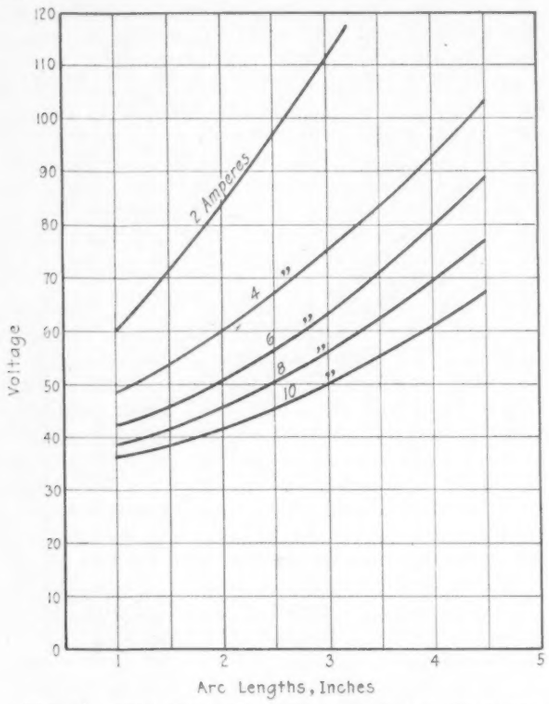


FIG. 4—RELATION OF ARC LENGTH TO VOLTAGE

As all of the liquids employed for supplying the active vapor are hygroscopic, and many of them readily decomposed by ordinary moist air, it becomes necessary to exhaust the air from the lamp, heat the lamp and electrodes while at a low pressure in order to remove the air films, and then admit the liquids without opening the lamp chamber of the air. This was accomplished by means of a bottle sealed to the lower extremity of the lamp and provided with a ground stop cock connecting it with the lamp. After the proper degree of exhaustion was reached, the desired liquid was carefully poured into the bottles and the stop cock opened slightly, when atmospheric pressure forced the liquid into the lamp chamber.

The appearance of the arc in this lamp is quite different from other commercial arc lamps (see Figs. 2 and 3). Among the vapors experimented with are antimony tetrachloride, carbon tetrachloride, stannic chloride, titanium tetrachloride, etc. The spectrum of the flame is usually quite different from the arc spectrum and is characteristic of the elements involved, while the spectrum of the arc independent of the ends of the electrodes (which, of course, give a hot-body spectrum) is usually a band spectrum and is practically continuous except for a few absorption lines.

Fig. 4 shows performance curves giving the relation between arc length and voltage, and shows the rate at which additional arc lengths require an increased voltage. The curve is also interesting as indicating that a 4-in. arc at 10 amp. requires no more voltage than a 1-in. arc at 2 amp. In other words, a 10-amp. arc is four times as long and therefore emits four times as much light as a 2-amp. arc. In addition, its intrinsic brilliancy is about five times that of a 2-amp. arc. Accordingly, the light emitted by a 10-amp. arc under these conditions is twenty times that of a 2-amp. arc, and since the wattage of a 10-amp. arc is only about five times that of the 2-amp. arc, the efficiency is approximately four times that of the 2-amp. arc. Efficiency curves indicate that 20 amp. is approximately the point of maximum efficiency of this particular antimony pentachloride lamp.

It should be understood, however, that the current of maximum efficiency differs widely with differences in the nature and pressure of the gas as well as the volume and available radiating surface of the lamp, and very efficient titanium bromochloride lamps have been constructed with a maximum efficiency of about 5 amp.

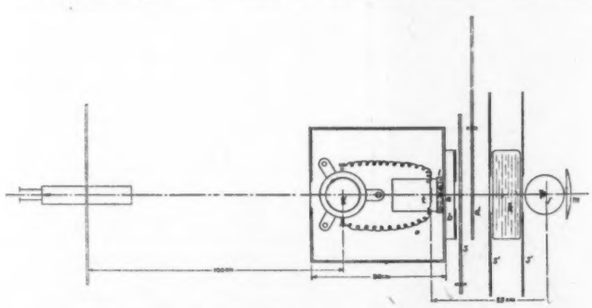
The author concluded that "it would appear that an investigation along the lines here described opens up new possibilities in light production, but it cannot be too strongly emphasized that while the results set forth in this paper offer considerable promise from an applied, practical standpoint, yet they are not presented for consideration as representing a finished device, but merely a research in what seems to be a new and interesting field."

Generators, Motors and Transformers

Three-Thousand-Kilowatt Motor-Generator. — CARL FRED HOLMBOE.—An article, illustrated by diagrams, giving details of the construction of a 3000-kw. motor-generator supplying direct current for the electrolytic generation of hydrogen and oxygen gases from water, the energy supply being in form of three-phase currents. The set consists of a 3500-kw., 4750-volt to 5250-volt, three-phase induction motor, running at 372 r.p.m. at fifty cycles per second, and a 3000-kw., 500-volt, 6000-amp. direct-current generator. The direct-current energy produced is 90 per cent of the three-phase energy consumed from three-fourths load to full load.—*Elek. Zeit.*, Oct. 14, 1915.

Lamps and Lighting

Physical Photometry with a Thermopile Artificial Eye.—HERBERT E. IVES AND E. F. KINGSBURY.—The present paper describes the development and practical use of an artificial eye consisting of a sensitive thermopile in conjunction with an absorbing medium whose transmission is a copy of the spectral luminosity curve of the average eye. This artificial eye differs from previous essays in the same direction in the accuracy with which it conforms to the latest determinations of the luminosity curve and in the fact that it has been



THERMOPILE EYE FOR USE IN PHOTOMETRY

exhaustively tested for its performance upon test color differences whose photometric values have been established by a satisfactory method of colored-light photometry. A linear bismuth-silver thermopile is used, and for the absorbing medium or "luminosity" curve solu-

tion one is used containing 68 grams cupric chloride, 14 grams cobalt ammonium sulphate, 10 grams potassium chromate, 15 cu. cm. nitric acid (1.05 grams), and water to 1 liter. The thermopile *t* (see cut), the luminosity-curve solution in a glass tank *l* 1 cm. thick, and the galvanometer *g* are all placed close together on the top of a concrete pier in an inclosing box. The box has a small aperture *a*, facing toward the 100-cp. stereopticon lamp *j*, 25 cm. distant. The radiation from the latter passes through openings in two tin screens *s'* and through the water tank *k*. A shutter *s* and a sector disk *d* are interposed between the luminosity-curve solution and the water tank. The absorbing solutions to be measured are placed on a ledge *b*. *m* is a concave mirror which may be placed behind the lamp to increase the size of the deflections when desired. The apparatus as shown in the diagram is arranged for the measurement of absorptions. It can, however, be just as well utilized for measuring the intensities of light sources. With the point-source carbon lamp, which gives approximately 45 cp. at "4-watt" color, deflections of 7 cm. are obtained without the concave reflector, and as much as 20 cm. with it. For the measurement of absorption the sensibility may be greatly increased by the use of a convex lens between light source and thermopile. Smaller light sources could be brought considerably nearer the thermopile. Actually no advantage is found in going over 5 cm. with the reflections, so that the sensibility of the apparatus in its present form seems sufficient for all ordinary purposes. Candle-powers as low as 8 can be measured accurately. As an additional result of the work of the authors a corrected value of the mechanical equivalent of light is given, namely, 1 lumen = 0.00159 watt of luminous flux.—*Phys. Review*, November, 1915.

Generation, Transmission and Distribution

Swedish State Hydroelectric Power Plant at Porjus.—The primary object of the Porjus power station is the electrification of the heavy Lapland iron-ore railway from Kiruna to the Norwegian frontier at Riksgränsen. The power plant supplies, however, energy also for industrial purposes. The plant is divided into five large units—two of 12,500-hp. maximum each, intended for the railway traffic; one of normally 12,500 hp., maximum about 14,000 hp., for power to the iron mines, and a reserve unit. The fifth unit will be installed only when the requisite demand for power has arisen. This long and profusely illustrated article is to be continued.—London *Engineering*, Oct. 15 and 22, 1915.

Supply of Electricity to Denmark.—A note stating that the transmission of electric energy from the power station at the Lagan Falls, in Halland, Sweden, through a cable under the sound, to Seeland, Denmark, will soon be an established fact. The war has retarded the installation, there being an embargo against the cable being exported from Germany, but the necessary amount of copper to effect an exchange has in the meantime been obtained, and the cable has arrived at Helsingborg. From a point near that town it will leave the Swedish coast. To begin with, the transmission is more in the nature of an experiment, and the energy will be distributed only within a comparatively small area; after two years' satisfactory working, another cable will be laid and a much larger district included in the supply, which is being taken by the North Seeland Electricity Company.—London *Engineering*, Oct. 22, 1915.

Traction

Electric Signaling on the New South Wales Railway.—In a paper read recently before the Electrical Association of Australia, W. F. Barton described the system of power signaling employed on the New South Wales railways. This is on the track-circuit principle, some sections of the line being completely automatic and others semi-automatic. The all-electric system is employed from Ashfield to Homebush and is operated at 60 volts; but in the busy parts around Sydney the signals are electropneumatic, compressed air at 65 lb. to 75 lb. per square inch being used, with current for the signal relays taken from accumulators at 17 volts. Track circuits are worked from 4-volt to 6-volt batteries. Edison cells have given good results in this work. Manual block working has now been entirely dispensed with in this area, which comprises the whole of the four main lines between Sydney and Homebush and Sydney and Sydenham; but at various places signal boxes are retained, at which certain sections may be operated either automatically or by hand, the last method being at times required for shunting.—London *Electrician*, Oct. 8, 1915.

Installations, Systems and Appliances

Dangerous Rise of Voltages.—W. PETERSON.—In case of breakage of a line with a single earth connection, and also in case of single-pole switch connections, dangerous rises of voltage occur with the frequency of the network. These are far more serious than other voltage rises. In three-phase systems the portion of the broken phase which is not connected to earth assumes continuously (until the line with the fault is disconnected) three and three-quarters to four times the normal voltage of the phase, and during the period of transient phenomena the voltage becomes even 30 per cent higher. If for any reason a single-pole connection between the power plant and a part of the line is brought about, the phase voltage becomes three and one-quarter to three and one-half times the normal voltage at the open and non-connected phases. The author discusses these and similar cases at considerable length and shows how they may be remedied.—*Elek. Zeit.*, July 15, 22 and 29, 1915.

Wires, Wiring and Conduits

No-Load Circuit-Breaker.—VON DROSTE.—An illustrated article giving details of construction of a modern automatic circuit-breaker which operates when the voltage becomes zero or decreases below a certain value. The article is illustrated by numerous diagrams.—*Elek. Zeit*, Aug. 5, 1915.

Electrophysics and Magnetism

Comparison of Radium Standard Solutions.—J. MORAN.—The object of this work was to determine the accurate value of the Rutherford-Boltwood standard solution at McGill University by comparison with the Washington standard solution. The former was compared first with the Rutherford-Boltwood solid standard, which is known to be 4.9 per cent too low as compared with the international standard. If no errors were made in their preparation, one would expect the solution standards to come out similarly. This work shows fair agreement, about 3 per cent low. The strong and the weak solutions of the Rutherford-Boltwood standard, prepared in the ratio of 100 to 1, turn out to be in fairly good agreement—probably within 2 per cent. This shows that no serious deterioration has occurred with time. It has been found that a radium-bromide solution deteriorates with each boiling; also that if a sufficient amount of hydrochloric acid free from radioactive matter is added, the solution will recover its normal emanating power. The cause of this has not yet been ascertained.—*Philos. Magazine*, October, 1915.

Miscellaneous

Calculating Electric Windings.—W. W. LOEBE.—The author describes a very simple graphical method for carrying out numerous calculations of the same kind. He uses charts containing logarithmic scales like those in the slide rule.—*Elek. Zeit.*, Aug. 26, 1915.

BANCROFT GHERARDI

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Bancroft Gherardi, engineer of plant of the American Telephone & Telegraph Company, who has had a prominent part in the recent achievement of commercial transcontinental telephony by his company, is the son of Rear-Admiral Gherardi, U. S. N., who in 1857, as a lieutenant on the old *Niagara,* was in charge of the boat which landed the American end of the first Atlantic cable. Bancroft Gherardi was born at San Francisco in 1873, was graduated from the Brooklyn Polytechnic Institute in 1891, and from Cornell he received the degrees of M. E. in 1893 and of M. M. E. in 1894. Joining the staff of the predecessor of the New York Telephone Company in 1895, he shortly afterward directed the preparation of a plan for 100,000 telephone lines within the areas of Manhattan and the Bronx. In 1901 he was appointed chief engineer of the New York & New Jersey Telephone Company, and in 1907 he became equipment engineer of the American Telephone & Telegraph Company. Since 1909 he has had the title of plant engineer, in charge of all plant development and standardization for the Bell system.

Robert E. Lee has been appointed auditor of the Houston Lighting & Power Company, succeeding H. H. Mason.

J. B. McAllister of Philadelphia, Pa., has been elected a director of the Electric Storage Battery Company, New York, to succeed the late Rudolph Ellis.

E. B. Goldsberry of Forsyth, Mont., has been appointed manager of the Hardin (Mont.) Electric Light & Power Company to succeed F. G. Fitzgerald, who recently resigned.

Harry Shockley, manager of the recent automobile show held at Cincinnati, Ohio, has been appointed manager of the electrical show to be held at Cincinnati Nov. 29 to Dec. 4.

H. A. Kinny has been appointed general manager of the Lansing (Mich.) Storage Company, which is engaged in the installation of isolated electric-lighting plants. Mr. Kinny was one of the early members of the American Institute of Electrical Engineers, his application having been indorsed by Alexander Graham Bell.

F. G. Fitzgerald, who has been manager of the Hardin (Mont.) Electric Light & Power Company since the plant was established about two years ago, has resigned and retired to his farm near Forsyth, Mont.

Ralph J. Andrews has been appointed commercial manager of the Patchogue (N. Y.) Electric Light Company. Mr. Andrews was formerly with the Suburban Gas & Electric Light Company of West Chester, Pa.

Charles Hayden of the Stone & Hayden Company, New York, has been elected a director of the Philadelphia Company and the Duquesne Light Company of Pittsburgh, Pa., succeeding W. B. Carson, resigned.

Warren L. Berry has been appointed industrial sales agent for the Union Electric Light & Power Company of St. Louis to fill the vacancy left by the resignation of W. L. Rose. Mr. Berry is a graduate of the Louisiana State University.

Walter L. Brown, Jr., formerly with the Rockingham County Light & Power Company, Portsmouth, N. H., has been appointed assistant superintendent of the Gloucester (Mass.) Electric Company. Mr. Brown had been with the Rockingham company for the past fifteen years.

Ira Berry, Jr., formerly assistant treasurer of the Galveston (Tex.) Electric Company, has been promoted and transferred to the Boston office of the Stone & Webster Corporation. He is to be connected with the treasurer's department there. Frank B. Flahive, now with the Paducah (Ky.) Traction & Light Company, will succeed Mr. Berry.

Hugh M. Wilson, first vice-president of the McGraw Publishing Company, publisher of the ELECTRICAL WORLD, suffered severe injuries to his face and side when he was struck by a speeding automobile while returning to his home near Scarsdale, N. Y., on the evening of Nov. 5. Mr. Wilson's injuries were painful, although not serious, and he is now making satisfactory progress toward recovery.

W. L. Rose has tendered his resignation as salesman for the Union Electric Light & Power Company of St. Louis, Mo., and will in the future operate a manufacturers' agency under the name of the W. L. Rose Supply Company. Mr. Rose was graduated from the electrical engineering course of Washington University at St. Louis in 1910 and has been in the employ of the Union Electric Light & Power Company's several departments continuously since that time.

E. W. JANSEN

E. W. Jansen, electrical engineer of the Illinois Central Railroad, Chicago, who has been elected president of the Association of Railway Electrical Engineers, gained his early electrical experience in construction work for the Quincy (Ill.) Electric Railway and for companies doing electrical installation at the World's Fair grounds in Chicago. His connection with the Illinois Central Railroad was begun in 1896, and as the company's electrical requirements grew Mr. Jansen rose through the ranks until, in 1904, when the electrical department of the road was organized, he was appointed chief electrician of the entire system, and in 1910 was made electrical engineer.

H. H. Mason, auditor of the Houston Lighting & Power Company, has been appointed auditor of the newly organized Texas Southern Electric Company, of which D. A. Hegarty is president.

Robert W. Hoy, commercial manager of the Harrisburg (Pa.) Light & Power Company, has resigned to accept a similar position with the Elmira (N. Y.) Water, Light & Power Company. Mr. Hoy has been with the Harrisburg company for twenty-eight years, beginning as an apprentice in the line department.

Obituary

Charles H. Conover, president of Hibbard, Spencer, Bartlett & Company, a Chicago hardware firm which does a large business in electric supplies, died at his Chicago home on Nov. 3. Mr. Conover entered the employ of the company at the age of ten and had served it continuously for forty-four years.

S. C. Dunham, the president of the Travelers' Insurance Company of Hartford, Conn., whose death on Oct. 26 was noted in last week's issue, was in that item incorrectly mentioned as being the president of the Hartford Electric Light Company. S. G. Dunham has been president of the Hartford Electric Light Company since the retirement of his brother, Austin C. Dunham, in 1912, and the regrettable confusion in our item arose from the similarity of names and initials.

New Apparatus and Appliances

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Industry

Nickel-Iron-Alkaline Cells for High-Discharge-Rate and Submarine Service

Batteries suitable for central-station standby service, for operating cranes, electric locomotives, submarine vessels and the like, have been developed by the Edison Storage Battery Company, Orange, N. J. The cells have a high discharge rate, are long-lived, and the amount of energy which they will deliver per unit of weight and volume is very high. Special attention has been given in the design to making the batteries applicable to submarine service, since this imposes many severe conditions. The cells are the result of several years' experimental work and have been subjected to the drastic tests which are characteristic of the Edison company.

Among the advantages which are claimed for this battery by the manufacturer are the following: The cells are compact, rugged and light in weight, and the plates cannot be injured or short-circuited by jolts, vibration or rolling and pitching of ships on which they may be installed. Chlorine gas cannot be generated within the cell, even if immersed in sea water. The cells are effectively sealed, and even if some of the electrolytes came in contact with surrounding metal work it would not start corrosion. "Forming" runs are unnecessary, so the battery efficiency in the long run is very high. Furthermore, the same ampere-hour rating is developed regardless of the rate at which the battery is discharged, and standing idle in a charged, semi-charged or discharged condition will not injure the plates. Of importance also is the fact that gas explosions cannot be communicated from the inside of the cell out or vice versa.

As regards composition of the electrodes and chemical reactions during battery charge and discharge, the cells are the same as the smaller nickel-iron-alkaline cells manufactured by the Edison company and now being used quite extensively on land. In details of construction, however, the batteries are quite different.

The fundamental principle of the Edison storage battery is the oxidation and reduction of metals in an electrolyte (potassium hydroxide) which does not dissolve and will not combine with either the metals or their oxides; also, an electrolyte which, notwithstanding its decomposition by the action of the battery, is immediately reformed in equal quantity, and is, therefore, a practically constant element without change of density or conductivity over long periods of time.

A symbolic representation of the electrochemical action in the cells follows:

In first charge—

$$Fe_2O_3 + 6K + 3H_2O = 2Fe + 6KOH \quad \text{(negative)};$$

$$3Ni(OH)_2 + 6(OH) = 3NiO_2 + 6H_2O \quad \text{(positive)}.$$

In discharge—

$$3Fe + 8(OH) = Fe_3O_4 + 4H_2O \quad \text{(negative)};$$

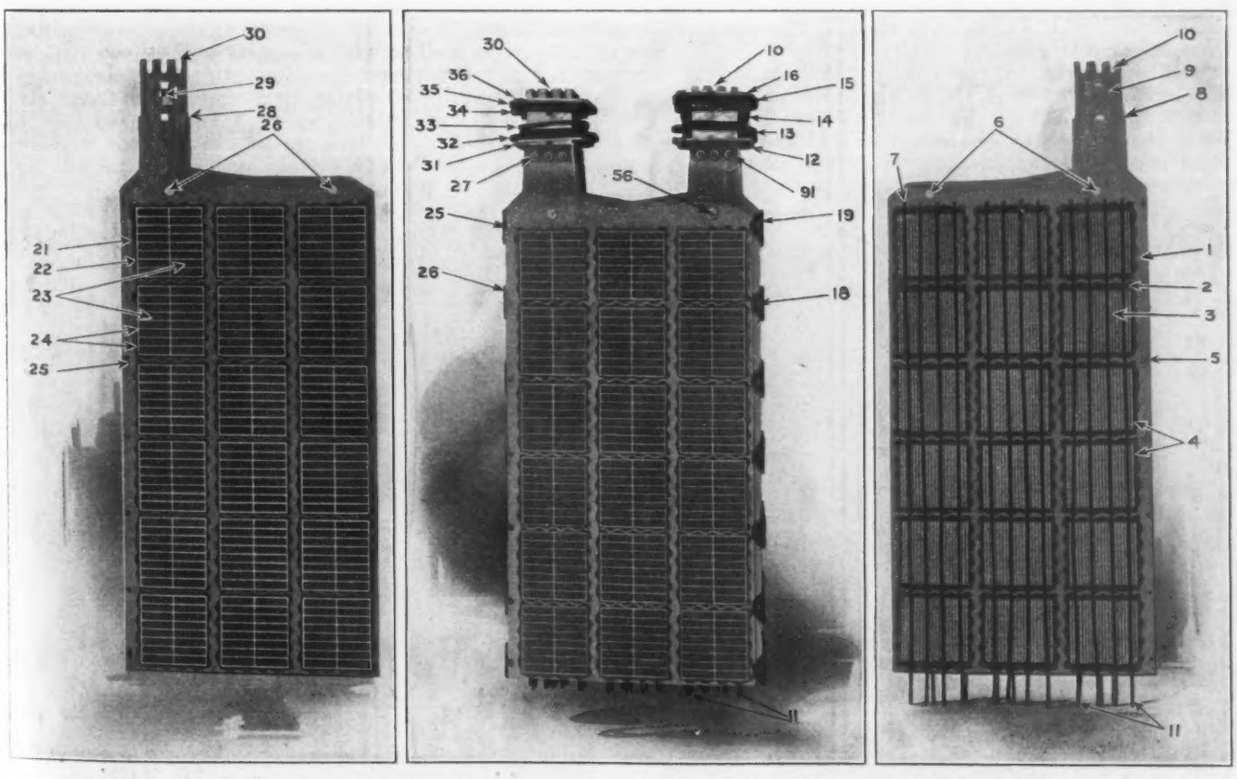
$$6NiO_2 + 8K + 4H_2O = 2Ni_3O_4 + 8KOH \quad \text{(positive)}.$$

In recharging—

$$Fe_3O_4 + 8K + 4H_2O = 3Fe + 8KOH \quad \text{(negative)};$$

$$2Ni_3O_4 + 8(OH) = 6NiO_2 + 4H_2O \quad \text{(positive)}.$$

The positive element consists of alternate layers of nickel hydrate and nickel flake inclosed in 3/16-in. per-



FIGS. 1, 2 AND 3—POSITIVE MAIN GRID, ASSEMBLED PLATES AND NEGATIVE MAIN GRID OF EDISON SUBMARINE BATTERY

1, 21—Negative and positive main-grid frames.
2, 23—Negative and positive sub-grids (see also Figs. 5 and 6).
3—Hairpin-shaped plate separators hooked through positive grids.
8, 26, 5, 25—Holes for plate-clamping bolts.
4, 24—Scalloped edges of sub-grids welded to main grids.
10, 30—Slots for bolts securing cell connectors.
19—Hard-rubber spacers, alternate plates and cell case.
8, 9, 28, 29—Holes for keys on each side of stuffing boxes.

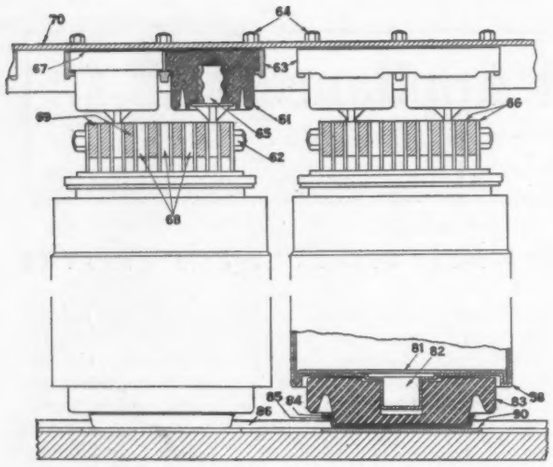


FIG. 4—INSULATING SUPPORT AND BRACING FOR CELLS

DATA ON SINGLE POSITIVE SUB-GRID

Discharge	Capacity	Discharge Rate, Amp.	Ampere-Hour Rating	Watt-Hour Rating	Average Volts	Ampere-Hour Efficiency, per Cent
10 hours to 1 volt	Rating	1.333	13.333	16.666		
10 hours to 1 volt	Actual	1.333	16.666	20.800	1.25	83.0
10 hours to 1 volt	Maximum	1.333	.....	23.088		
5 hours to 1 volt	Rating	2.666	13.333	16.266		
5 hours to 1 volt	Actual	2.666	16.666	20.333	1.22	83.0
5 hours to 1 volt	Maximum	2.666	.....	22.569		
3 hours to 1 volt	Rating	4.444	13.333	15.600		
3 hours to 1 volt	Actual	4.444	16.666	19.133	1.17	81.0
3 hours to 1 volt	Maximum	4.444	.....	21.237		
1 hour to 0.9 volt	Rating	10.555	10.555	10.555		
1 hour to 0.9 volt	Actual	10.555	13.333	13.333	1.00	80.0
1 hour to 0.9 volt	Maximum	10.555	.....	14.799		

forated steel tubes 4.5 in. long. Twenty of these clamped in a frame form what is termed a positive sub-grid. The negative element is iron oxide mixed with a small quantity of mercury. This is packed in flat, perforated, rectangular pockets, also of steel, and measuring 2 3/16 in. by 1.2 in. by 1/10 in. The negative sub-grids contain sixteen negative pockets. The metallic nickel in the positive tubes and the mercury in the negative pockets improve the conductivity of the active material.

The main grids are made up of steel frames to which are welded the sub-grids, the standard grids being three sub-grids wide and five or six high, such plates being designated as 5 by 3 and 6 by 3 respectively. Each pair of sub-grids (positive and negative) are normally rated at 15.6 watt-hours when discharged at 4.44 amp. to 1 volt, so that the total rating of a cell can be easily computed, knowing the number of positive sub-grids.

When the plates are assembled for placing in the cells hard-rubber strips are secured between adjacent plates and those of like polarity bolted together along the edge nearest the "neck" terminals. Assembled on these bolts between plates of the same polarity are hard-rubber spacers which hold the plates rigid and prevent their touching each other or the containing steel cans.

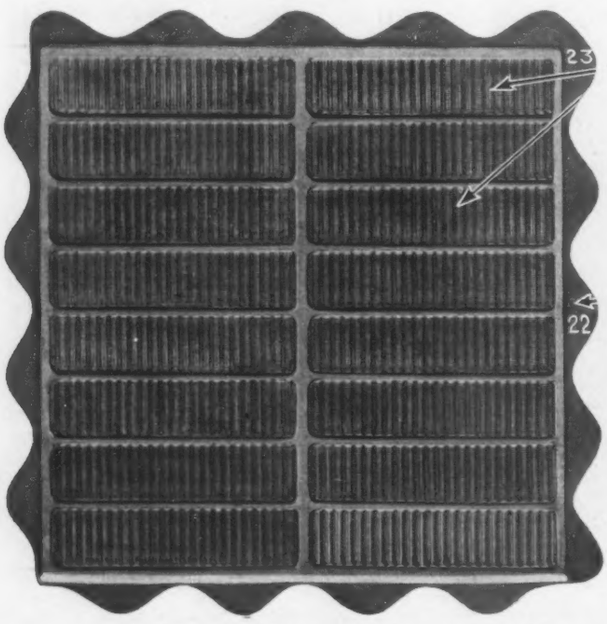
The containers consist of cold-rolled steel, all seams being welded. To the bottom of each are welded two inverted cup-shaped projections that fit in porcelain petticoat insulators which serve as seats for the batteries. The exteriors of the containers are covered with semi-hard rubber vulcanized thereto. The tops of the containers, which are of steel, effectively seal the containers since they are welded to the sides and contain stuffing boxes for the plate terminals. A drain tube, filling aperture, water seal (or ventilating outlet) and a lifting ring are also provided in the top.

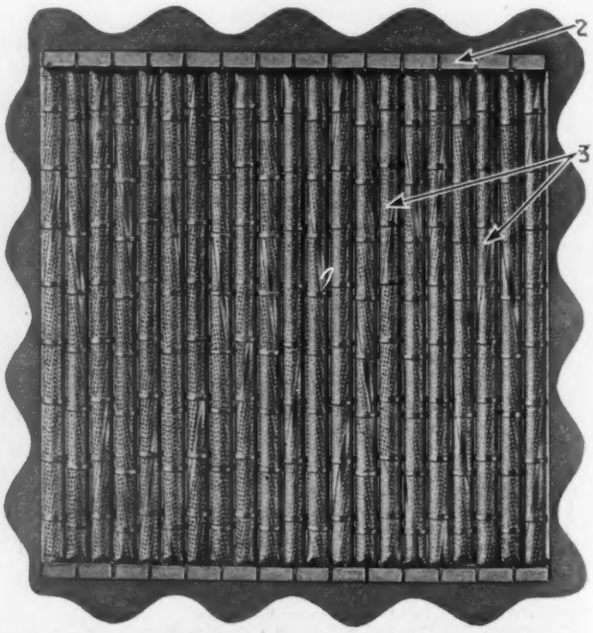
The drain tube extends down one side of the cell to within ½ in. of the bottom so that electrolyte can be removed without disturbing the cell. This is done by attaching tubes to the water-seal outlet and drain-tube outlet and applying compressed air to the former.

The stuffing boxes contain soft-rubber packing clamped between ridged hard-rubber pieces which expand the packing and insulate the poles from the covers. Keys passing through the plate terminals above and below the stuffing boxes serve to support the plates.

The water seal serves a double purpose. It washes gases issuing from the cell of any potash and also prevents impurities getting into cell and avoids possibility of all explosions.

Insulation of the cells from each other and the method of bracing them where they are installed in submarines or other places where they will be subjected to violent motion are clearly illustrated in an accompanying line drawing. This shows the bottom petticoat insulators resting in semi-hard rubber padded steel strips attached to the battery-tank bottom. Cells in the same row are connected electrically and spaced mechanically by nickel-plated copper conducting strips bolted between the plate terminals. Also secured between the neck of each group of plates is a vertical insulator pin articulating with and cemented in a porcelain petticoat insulator held in padded steel holders attached to athwartship members.

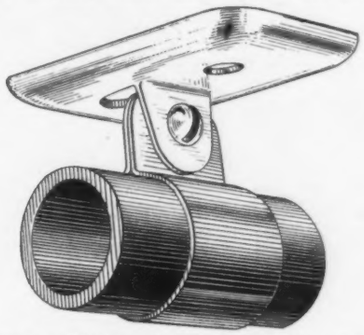




FIGS. 5 AND 6—NEGATIVE AND POSITIVE SUB-GRIDS. THERE ARE EIGHTEEN OF THESE PANELS IN EACH MAIN GRID

Conduit Hanger with Ceiling Plate Attached

An improved conduit hanger or pipe clip, equipped with a ceiling plate, has been developed by the Thomas Wrigley Company of 416 South Dearborn Street, Chicago. The advantages claimed for this hanger are that it covers up broken places in the plastering made by drilling the anchor hole for the toggle bolt and that it is easy to install, since the toggle-bolt hole is not in line with the pipe. With the use of this device time may be saved in installing conduit by first putting up all ceiling plates and later attaching the conduit clips to these plates. Both the clips and the ceiling plates are made of cold-drawn steel and are finished in black enamel.

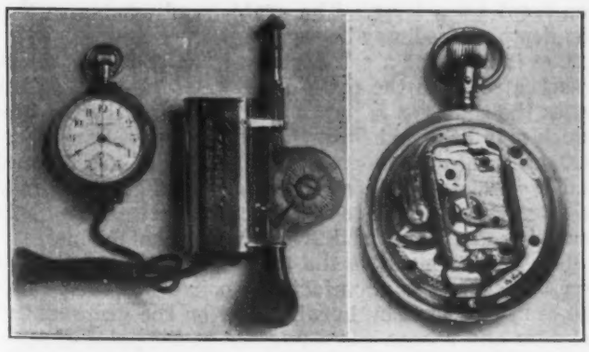


CONDUIT HANGER WITH CEILING PLATE FOR COVERING BROKEN PLACES

Electrical Revolution Counter and Stop-Watch

A few years ago a patent on the combination of an electrically connected revolution counter and stop-watch was granted to Frederic A. De Lay, 72 West Adams Street, Chicago. (See ELECTRICAL WORLD, Aug. 9, 1913.) Recently Mr. De Lay secured another patent on an improvement in the details of the watch itself. As shown in one of the illustrations, a small electromagnet placed within the watchcase is so arranged that the sweep hand is engaged when the circuit is open and is disengaged when the circuit is closed. This arrangement permits accurate timing of any operation in which starting and stopping can be made to open and to close the circuit of the electromagnet.

Another illustration shows the watch as used with the De Lay electric revolution counter. Here the revolution counter and the watch are connected together electrically, so that as the counter starts to turn the electrical circuit is automatically opened and the watch started. The watch and counter automatically stop at the same time, since stopping the counter's shaft again closes the electromagnet's circuit. A bank of these watches as arranged for timing foot races is shown in Fig. 3. Each of the six watches represents one of the lanes into which the track is divided at the finish. All watches are started at the crack of the starter's gun and each watch is automatically stopped as the runner in his respective lane crosses the tape. The watches have also been found especially useful in testing and in experimental work. The electromagnetic device does not interfere with the use of the watch as a timekeeper or as a manually operated stop-watch.



FIGS. 1 AND 2—REVOLUTION COUNTER AND WATCH ELECTRICALLY INTERCONNECTED

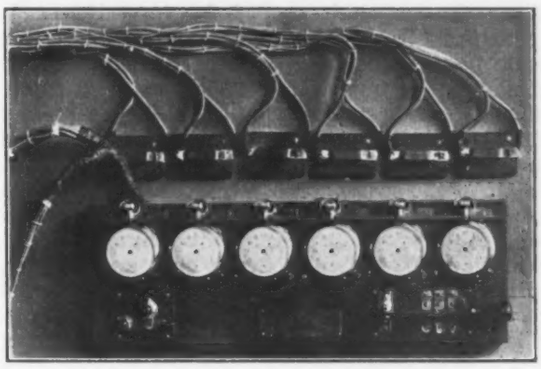
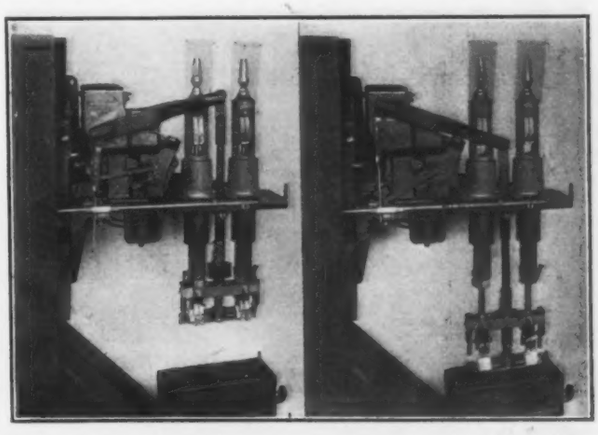


FIG. 3—ELECTRICALLY OPERATED STOP-WATCHES READY TO TIME A 220-YARD DASH

A Three-in-One Oil and Disconnecting Switch

A switch designed to perform the functions of the two disconnecting switches and the oil switch ordinarily used on a high-potential station circuit has been developed by the electrical engineering department of the Commonwealth Edison Company of Chicago under the direction of B. G. Jamieson, its patentee. In the accompanying illustrations is shown a test model of this switch in the closed and the open position. Operation of the oil-break and the air-disconnecting contacts is entirely automatic.

In normal operation the switch action from the closed to the open position is in two distinct steps. When the operator actuates the opening control switch the oil break opens immediately to its full open position, and following a predetermined time interval regulated by a dash-pot the air break automatically opens. Investigations have shown that if proper closing speed and voltage relations are maintained the oil break may be closed first and the air break later without burning the air-break contacts. One style of construction developed,



FIGS. 1 AND 2—COMBINATION OIL AND DISCONNECTING SWITCH IN OPEN AND CLOSED POSITIONS

however, contemplates closing the air break first. Both gaps are closed automatically by the operator actuating the closing control lever in the usual manner. Under normal conditions this cycle of operation opens and closes two gaps in the line and accomplishes all of the functions ordinarily performed by both oil and disconnecting switches.

When the switch is opened for inspection and repairs it is desirable that the inspector shall be able to operate its mechanism without energizing the circuit it controls. To permit this, provision has been made for telescoping the members connecting the air-break and oil-break contactors. This operation is accomplished by manipulation of the horizontal lever shown along the bedplate of the switch. When these members have been telescoped the switch may be operated at will without closing the air-break contacts above the bedplate.

To relieve the switch of heavy duty under abnormal conditions such as are created by frequent opening during storms or short-circuits, provision has been made for locking the disconnecting portion of the switch closed. With a spring catch the switch may also be locked in its open position to guard against careless operation, and to prevent malicious damage a padlock may be added.

Automatic Chain-Grate Stokers

A self-contained stoker of the automatic chain-grate type, which is so designed that both the ignition arch and the stoking apparatus are practically independent of the side walls for support, has been developed by the Nosmoke Stoker Company, 90 West Street, New York. This construction, it is claimed, relieves the furnace walls of strain and is adapted to forced, induced or natural draft. An installation of one of the stokers under a 530-hp. Babcock & Wilcox boiler is shown in Fig. 1, and a side view of the apparatus is shown in Fig. 2.

The side frames of the stoker are supported on wheels so that the apparatus may be withdrawn at any time. The entire run of grates is supported by the lower rollers so that the grate as a whole, it is claimed, is flexible. For maintaining the proper distance between the upper and lower runs of grates, idlers are interposed between the upper and lower runs of chain and kept in lateral

FIG. 1—CHAIN-GRATE STOKER UNDER 530-HP. BOILER

position by piping placed loosely in bearings on the side frames. Thus the upper run of grates bears on the idlers, which in turn bear on the lower run which works over the lower rollers.

The driving mechanism is on the front shaft and consists of a double worm drive; that is, the worm shaft is itself driven by a worm, and the second worm is driven by a Reeves variable transmission, which may be belted to a counter shaft or driven direct. Sprockets keyed to the front shaft propel the chains to which grate bars are attached. The rear shaft is free to turn, as are the sprockets, which are mounted loosely on it,

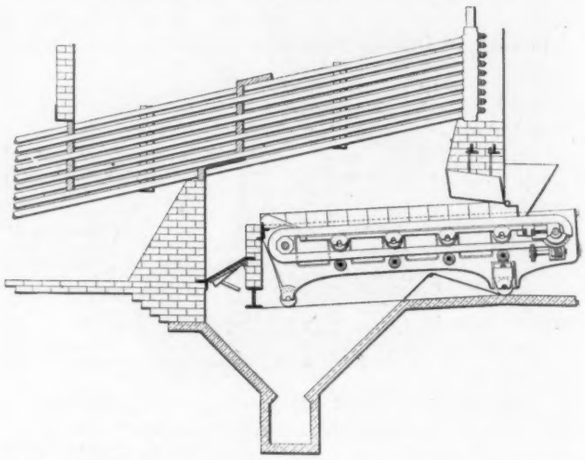


FIG. 2—SIDE VIEW OF STOKING APPARATUS, SHOWING METHOD OF AGITATING FUEL BED

thus keeping the tension uniform, it is asserted, on the upper and lower runs of chains. All parts are interchangeable. The grate bars intermesh, leaving openings for sufficient air passage, but not so large that coal can pass through, and automatically clean themselves.

In stokers where the width of the fire-box exceeds 7 ft. a patented device is used to support the lower rollers where the deflection, owing to the weight of the grates, would be greatest.

The ignition arch presents a flat under surface and is composed of multiple arches suspended from T-beams supported by the side walls. The T-beams are free to expand and contract without affecting their supports. The retard plates, which are air-cooled and are at the rear of the stoker, are so designed that the fuel bed at that part of the stoker is backed up in order that the air shall not pass any more freely through the ashes and partly consumed fuel than it does through the burning fuel at the front where the fire is more intense. The dumping apparatus at the rear of the stoker is so arranged that no air can pass through or around it to cool off the furnace gases, and is easily operated from the front by a lever. The grate is adjustable so that the depth of feed may be regulated.

Use is made of a self-contained ash conveyor, which is actuated from the main drive. Before dumping the ashes the conveyor is put in operation, and the fine coal which may be sifted through is first removed and shoveled back into the hopper, then the ashes are dumped and brought forward by the conveyor. The stoker may be operated by hand, should occasion arise, by simply removing the hopper and firing in the usual manner.

The arrangement of the arch in its relation to the grate is such, the manufacturer points out, that after the arch is heated by burning fuel on the grate all the volatiles and unseen gases released at the point of ignition are turned into heat units before escaping from the arch, thus adding to the efficiency of the fuel and consequently preventing the formation of smoke.

Where the natural draft is affected by atmospheric conditions, a pipe filled with small holes is placed between the revolving grates immediately under the point of ignition. A blower is attached to the pipe and is used when necessary to emphasize the ignition or to give the correct mixture of oxygen.

Alternating-Current Fire-Alarm Apparatus

In many factories which are required under State and municipal regulations to maintain fire-alarm signal systems alternating current only is available. In the accompanying illustrations a recent development of fire-alarm equipment is shown suitable for direct operation

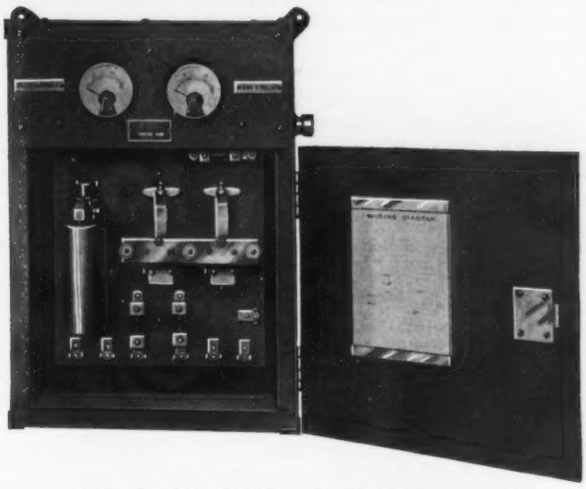


FIG. 1—ONE-GONG-CIRCUIT CONTROL BOARD

from 110/125-volt alternating-current service lines. The diagram in Fig. 2 shows positive and ground terminals at *D*-1 and *D*-2 connected to 125-volt alternating-current lighting-service lines. The terminals represent the main fuses of the control board shown in Fig. 1. The signal boxes *E* are connected to *A*-1 and *A*-2, and one or more series of gongs are connected to the terminals *B*-1, *B*-2 and *E*-1, *E*-2, etc. *J* is a trouble bell, *G* a time-limit cut-out, and *H*, *H* and *I* are indicating milammeters in series with the bell and box circuits.

The equipment consists of a control board provided with relays and instruments connected directly to the alternating-current circuit and controlling the operation of one or more series of alternating-current bells. The system is of the closed-circuit type with box and bell circuits under the supervision of indicating instruments, which show their condition. A time-limit cut-out and accurately rated fuse protect the apparatus in the event of abnormal current conditions. A fall in potential or an open circuit in the alarm system causes the trouble bell, operated by four dry cells, to ring. The bell circuits are protected by a time-limit cut-out in the event of a box circuit becoming open. The control board and wiring system shown in the illustrations are of the "New York type," complying with the regulations of the New York State Industrial Board covering factory fire-alarm systems. The apparatus is being made by the Palmer Electric & Manufacturing Company, Boston, Mass.

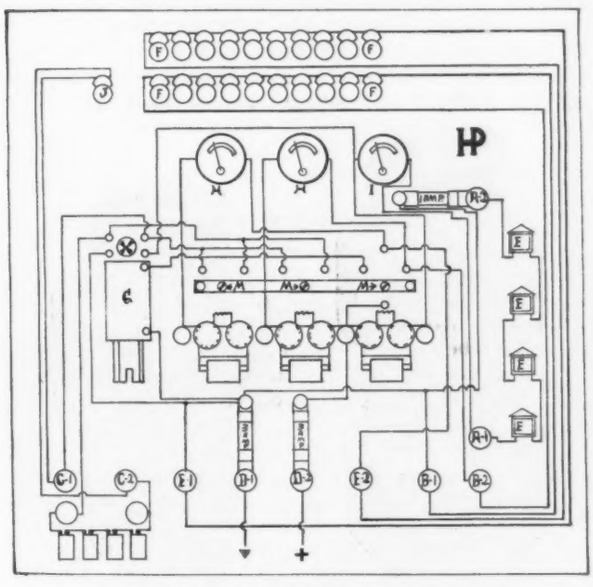


FIG. 2—TWO-GONG-CIRCUIT DIAGRAM

Portable Vise Stand and Pipe Bender

A handy device for electricians which can be utilized as a pipe bender, as shown in Fig. 1, or as a vise for threading the pipe, and which can be packed in the form shown in Fig. 2 for carrying from place to place, has been developed by H. P. Martin & Sons, Owensboro, Ky.

FIG. 1—DEVICE USED AS PIPE BENDER

The device is designed for use in bending pipe or conduit from ⅛ in. to ¾ in. in diameter. The rear legs of the stand are at an obtuse angle so that great pressure may be exerted down on the pipe without tilting or upsetting the stand. The stand is equipped with a No. 1 Vulcan vise for threading pipe. When the pipe is to be cut or threaded it is fastened in the vise, and the bending device then acts as a guide and rest. The front legs of the stand are almost perpendicular so that short nipples can be threaded or short pieces cut without the handles of the stocks striking them. The stand is made of No. 16 sheet iron, which is thoroughly riveted and braced with angle irons. The legs are of ¾-in. pipe and slip into sockets when the stand is set up.

FIG. 2—LEGS REMOVED FOR CARRYING PURPOSES

The manufacturers point out that the side braces make a convenient place for wrenches, cutters, etc. When the stocks are not in use they can be placed on these braces and the oil will drain off without running down the handles. The apparatus complete weighs 45 lb.

Multiple-Basket Strainer Operated Hydraulically or by Compressed Air

An improved self-contained water strainer of the removable straining-basket type for power-plant and pumping-station intake lines has been developed by the Lagonda Manufacturing Company, Springfield, Ohio. The baskets are raised and lowered by air or water pressure. Fig. 1 shows a complete hydraulic or air-operated

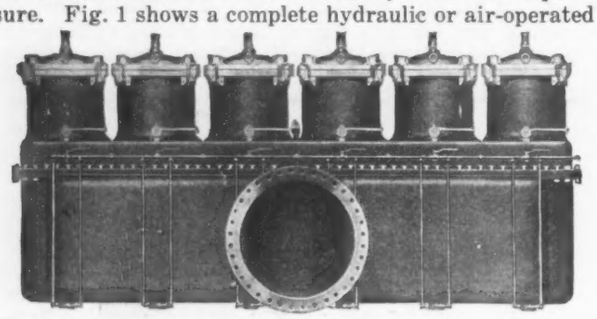


FIG. 1—42-IN. SIX-BASKET HYDRAULICALLY OPERATED STRAINER

strainer of the six-basket type. Each basket is an independent unit, with cleaning-chamber valve and air or water control, and it can be independently raised, removed and cleaned without interrupting the operation of the remaining baskets.

In Fig. 2 is shown a section of the strainer through one basket, illustrating the construction and operation of the baskets and raising mechanism. The straining

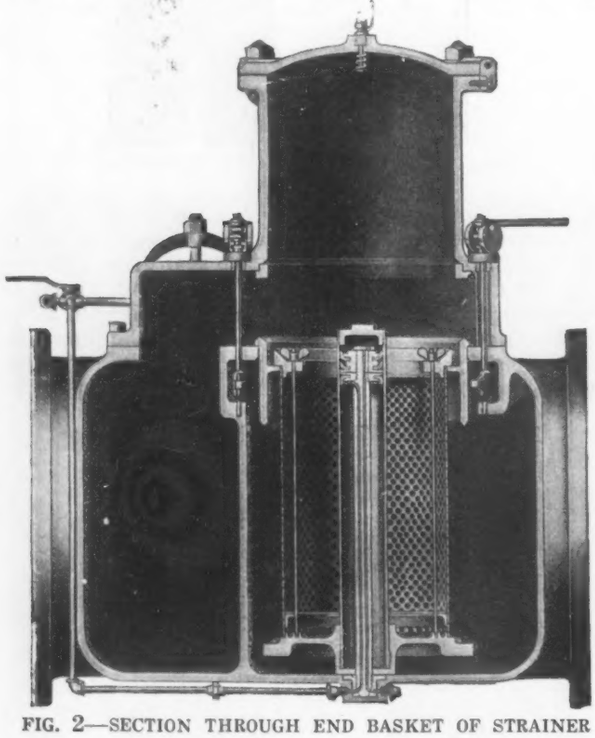
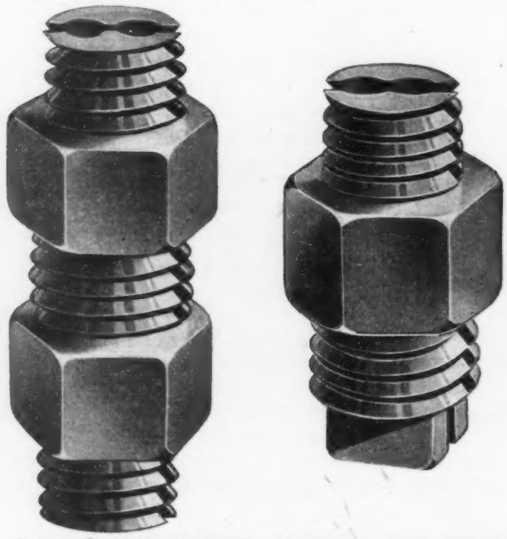


FIG. 2—SECTION THROUGH END BASKET OF STRAINER

basket is rigidly supported on a circular base or disk which also serves as a valve seat when the basket is raised. Attached to the disk is a cylinder of small diameter, the whole moving freely up and down on a piston and piston rod rigidly connected to the strainer body. The piston rod is provided with two conduits, communicating with the upper and lower sides of the piston and connected as shown through a four-way control valve to the pump or compressor supply. The operation of raising or lowering a basket is similar to that of an air brake. Throwing the handle of the four-way valve to one side, pressure is applied to the top side of the piston and the basket is raised to the cleaning chamber. The basket support or lower valve seat engages the sliding valve collar of the strainer, carrying it up with the basket to close completely the cleaning chamber or bonnet. The air or water pressure is sufficient to seal the valve water-tight, but for assurance against possible leakage or chance lowering of the disk while a basket is removed a cam lever-locking device is provided on either side of the strainer bonnets as shown. With the basket raised, the handle of the locking device is raised in a vertical position, then swung around until the projecting support shown in Fig. 2 is swung under the valve disk. The handle is then drawn down into the horizontal position. The cam draws the support tight up against the disk, insuring a tight fit and locking it in place. When the basket is raised the top of the cylinder engages and raises the indicator rod in the top of the flange cap, which shows the basket is in the cleaning chamber. As soon as the basket is lowered the spring pulls the indicator rod down, showing the basket in the straining position. In the flange cap a pet-cock is provided for relieving any pressure in the cleaning chamber, so the hinged flange cap can be easily unbolted and opened for the quick removal of the basket. With the basket reinserted and the flange cap bolted down, the basket is lowered into position by releasing the locking device and throwing the handle of the four-way control valve to the opposite side.

Wedging Guy Clamp

The Gund Manufacturing Company of La Crosse, Wis., has brought out a guy clamp in which an exterior nut turned over a split and tapered screw holds the stranded guy wire. The thread of the nut is also tapered and the taper ratio of both threads is arranged so that the clamp closes only 0.1 in. for each inch of nut

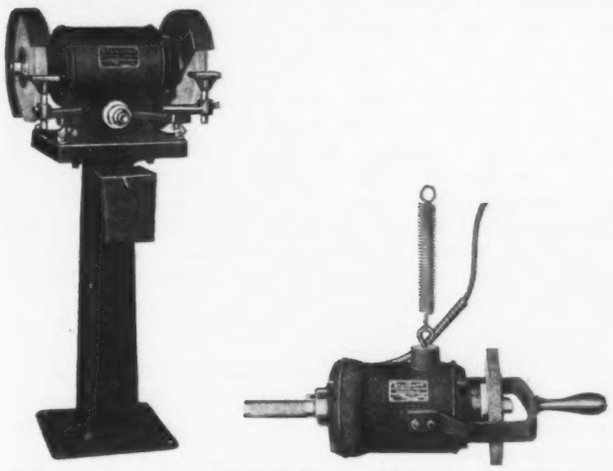


FIGS. 1 AND 2—DOUBLE-NUT AND SINGLE-NUT GUY CLAMPS

travel. The clamps are made in two styles, that is, small clamps with one nut for all sizes of guy wire up to 0.375 in. in diameter, and double clamps with two nuts for 0.375-in., 0.4375-in., 0.5-in. and 0.625-in. wire.

Electrically Operated Grinder

In the accompanying illustrations are shown motor-driven grinders of the pedestal and so-called aerial type which have recently been placed on the market by the Standard Electric Tool Company, Cincinnati, Ohio. The pedestal type of machine is made in two sizes, operated by 0.5-hp. and 1-hp. motors, and carries wheels 8 in. by 0.75 in. and 10 in. by 1 in. respectively. When equipped with the proper kind of accessories, the machine may also be utilized for buffing. Ball bearings of the double-row, self-aligning type are used throughout and they are incased in grease in dustproof chambers. The aerial grinder shown in Fig. 2 is built in two sizes with ratings of 0.5 hp. and 1 hp. respectively, and may be suspended from the ceiling or other support by means of the spring shown. The machine is very serviceable, the manufacturer claims, for grinding rough castings or buffing. Double-row self-aligning ball bearings are also employed throughout in this machine. An emery wheel 8 in. in diameter with an 0.75-in. face is employed with the smaller machine and one 10 in. in diameter with a 1-in. face with the larger. Motors for both types of machines are provided with windings impregnated with "bakelite" and are designed for very rugged service.



FIGS. 1 AND 2—MOTOR-DRIVEN GRINDERS OF PEDESTAL AND SUSPENSION TYPES

Electrically Operated Vacuum Pump

A high-vacuum pump of the oscillating-ring type, consisting of four parts—the body, impeller, cover and shaft—is shown in Fig. 1 with cover removed. A series of concentric grooves are cut in the body and impeller and are so arranged that each of the rings formed in the latter projects into a corresponding groove in the stationary part of the apparatus. In each of the grooves cut in the body there are dividing walls, and the corresponding parts of the impeller rings are cut away. The two, three or whatever number of grooves there may be are connected in series by ports. The action of the pump depends on the rolling contact made between the external cylindrical surfaces of either piece and the adjacent internal cylindrical surfaces, the air and vapor being pushed ahead of it. Moisture and liquid will also pass through the pump.

The operating principles of this pump are shown in Fig. 2. The two cross-hatched rings represent the pump impeller and the solid rings represent the body. S' is the port connected to the vessel to be evacuated, D' is connected to S^2 and D^2 is the discharge. The rotation of the shaft produces first an increase in the size of the crescent-shaped space adjacent to S', thus drawing in the air. Then S' is closed off from the space by the further rotation of the impeller and D' is opened to it. The space now decreases in size, thus forcing the air out of D'. S^2 draws the air away from D' and it is finally discharged out of D^2. Both sides of the impeller are effective; therefore there are two double-acting rings working in series. The three-ring pumps operate in the same way except that the air passes around a third ring in series with the other two before it is finally discharged. The pump is of cast iron throughout and is equipped with bronze bearings.

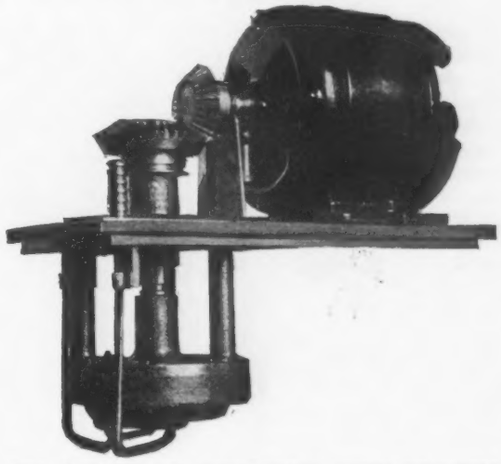


FIG. 1—VACUUM PUMP WITH COVER REMOVED

The outfit shown in Fig. 1 is a three-ring pump with a displacement of 930 cu. in. of free air per minute, and the maximum vacuum obtained is 0.25 mm. The over-all dimensions of the outfit are 12 in. long by 7 in. wide by 13.75 in. high to the top of the motor. The weight with oil is 75 lb. The gears are covered with a guard, and the outfit is placed in a tank which contains oil. The gear guard and tank are not shown in the illus-

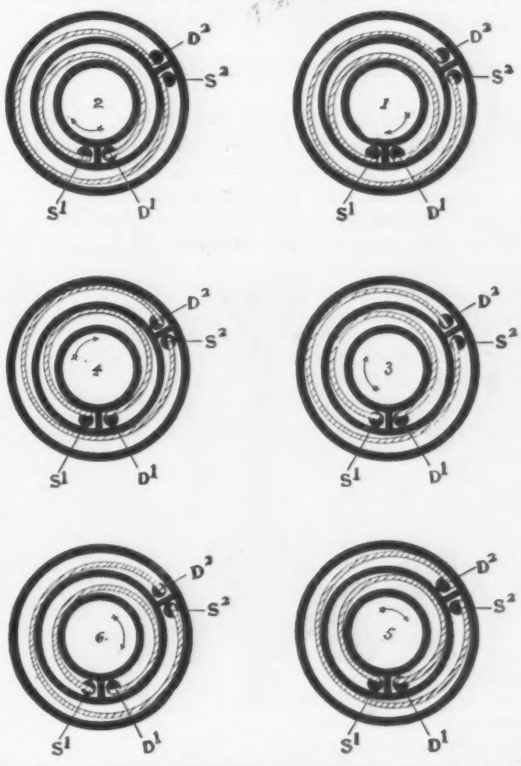


FIG. 2—DIAGRAM SHOWING PRINCIPLE OF OPERATION

tration. The pump is being made by the May-Nelson Manufacturing Company, Washington, D. C., and is sold through Eimer & Amend, New York. It is operated by a 0.1-hp. motor made by the Robbins & Myers Company, Springfield, Ohio.

Gyrating Fans

With the idea of directing streams of air in every direction and stirring all the air in a room without creating a strong draft, the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has brought out several types of gyrating-fan outfits which may be mounted on stands, as shown in Fig. 1, or suspended from the ceiling, as shown in Fig. 2. Each outfit is provided with two fans which can be tilted at any desired angle from the horizontal and which revolve about a central axis. The air currents caused by the fans are felt in every part of the adjacent space. The gyrating fans have a wind sweep of 30 ft. to 35 ft. and can be separated by that distance with good results. Gyration does not depend on the air reaction but is accomplished by mechanical drive from one of the fan motors. Each fan is equipped with six blades and is 12 in. in diameter. The gyrating mechanism is mounted on a ball bearing.

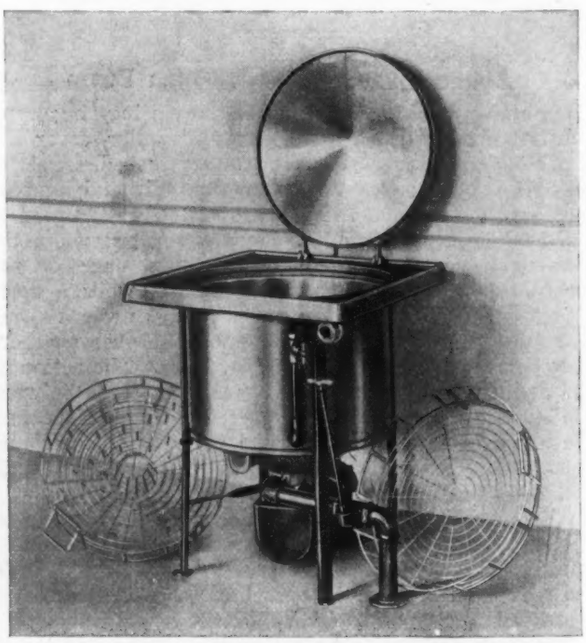
FIG. 1—GYRATING FANS MOUNTED ON STAND

FIG. 2—GYRATING FANS MOUNTED FOR SUSPENSION FROM CEILING

The fans can be tilted from a horizontal position to an angle of 35 deg. below horizontal by means of a positive wing-nut adjustment at the side of the gyrating mechanism. By turning this wing nut both fans can be raised or lowered to the same angle. The fans operate at three speeds and are controlled by a convenient switch. At full speed the fans revolve about seven times a minute. In spite of the tilting of the fans and the centrifugal force developed in gyrating, the manufacturer points out that no oil can be thrown from the fan bearings, as special bearings are provided for the purpose. Vaseline is employed to lubricate the outer bearings and the gyrating mechanism is packed in heavy grease.

Heavy-Service Electric Dish Washer

A "one-tank" motor-driven dish-washing machine designed for use in hotels, restaurants, etc., is shown herewith. The dishes are placed in the tank on special trays, four styles of trays being provided, one for flat china, one for cups, bowls and glasses, one for silver and one for milk bottles. When the trays are removed there is nothing in the tank except the "dasher" resting in the bottom, which is connected to the motor mounted below the tank, as shown in the illustration. The "dasher" throws the water up, through and between all the dishes, washing them thoroughly, it is declared. The dish washer is equipped with a hinged cover which prevents slopping of water and confines all steam. It requires only 28 sq. in. of floor space. The right and left ends of the top are removable so that two or more machines can be fastened together and the removable end replaced, giving the "battery" a finished appearance. The dish washer can easily be installed, as it is only necessary to connect a hot-water pipe to the container and also connect the tank to a drainage pipe. The water is changed after each operation. The dish washer is being made by the Walker Brothers Company, Syracuse, N. Y.



ELECTRIC DISH WASHER FOR HOTELS AND RESTAURANTS

Property Owners to Pay for Most of Butte's New Lighting System.—The new lighting system of Butte, Mont., to cost $35,000, will be paid for by the city, railway company and property owners of the district improved as follows: City, 25 per cent; railway company, 12.5 per cent, and property owners, 62.5 per cent.

Electric Tar Filter for Gas Works.—Patents have been issued to F. W. Steere of Detroit, Mich., for electrically removing tarry substances from gas. The operation consists of passing the gas through an electrical field of alternating polarity between receiving and discharging electrodes. The particles of tar in the gas then coalesce and are deposited on the receiving electrode.

A. S. M. E. Boiler Code.—A second edition of the boiler code of the American Society of Mechanical Engineers which contains a comprehensive index to the volume has been issued. The index is divided into two parts, one a general index to the complete rules and the other containing sectional indexes to the parts referring to new installation of power boilers, new installation of heating boilers, and existing installation.

Pennsylvania Welfare, Efficiency and Engineering Conference.—The third Pennsylvania Welfare, Efficiency and Engineering Conference will be held in the hall of the House of Representatives in the Capitol at Harrisburg on Nov. 16, 17 and 18. The conference is called for the purpose of familiarizing the public and the various departments of the State government with the work of the separate departments which have to deal in a responsible manner with State engineering projects, natural resources and industries. Talks will be given by the heads of the various departments descriptive of the work under their control and its relation to the public. Addresses upon subjects relating to the work administered by the various branches of the State government cooperating in the conference will be given by men posted on the subjects.

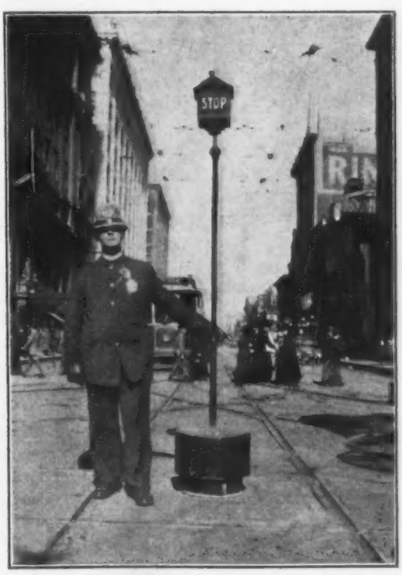
Course of Study in Export Trade.—A free course in the study of export trade has been established by the College of the City of New York. The course, which is designed to give the students an opportunity to study methods employed by successful exporters, will be given largely by business men and will cover sales organization and sales methods in foreign trade, financial organization, transportation problems, and government regulations affecting international trade. The direction of the course is in the hands of an advisory committee composed of representatives of the College of the City of New York, the American Manufacturers' Export Association, the Merchants' Association of New York, the National Association of Manufacturers, and the Board of Trade and Transportation. Dr. Guy Edward Snider, College of the City of New York, is director of the course.

Multiphase Currents

Miscellaneous News Items Picked from the Happenings of the Industry

Standardization of Appliances in Doherty Organization.—A committee has been appointed from the members of the Doherty organization for the purpose of considering the standardization of gas and electrical appliances in the different affiliated and controlled properties. The committee is composed of F. J. Petura, New York, chairman; George Williams, New York; F. C. Weber, New York; C. H. Merritt, Danbury, Conn.; H. D. Frueauff, Sedalia, Mo.; Clare N. Stannard, Denver, Col., and A. K. Young, Toledo, Ohio.

Battery-Operated Traffic Signals.—The rapidly increasing volume of automobile traffic on city streets is creating a problem for many local police departments. At Indianapolis, Ind., and in other cities electrically lighted, manually operated signals are being used at some of the busier corners. The devices in use at the Hoosier capital have already passed the experimental stage and about forty of the type shown are now in process of construction for local use. A single lamp operated by a storage battery illuminates the "Stop" and "Go" signs. On the corners where it is necessary to use the lamps only an hour or two each evening the operation of the small vehicle-type storage batteries has proved satisfactory. But on posts where the lamps are operated continuously from dusk till 11.30 p. m. recharging is required so frequently that some of the corner "cops" have ventured to assert that "the lamps ought to be connected to the electric-light company's wires."



THESE SIGNALS SHINE FORTH AT NIGHT FROM BATTERY-LIGHTED LAMPS

Telephone Company Educates Office Boys.—In order to educate the office boys so that they may be of further use to the company when they get to be too old for the office boys' duties, the Chicago Telephone Company has opened a school for its office boys. The company gives the books and time and has arranged with the Y. M. C. A. to furnish the instructors. Regular schoolrooms have been fitted up and classes meet three times a week from 12 to 2 o'clock.

Huge Induction Coil for X-Ray Work.—An induction coil 8 ft. in length and 37 in. in diameter has been developed by C. H. Stanley, New York City, for making X-ray photographs and fluoroscopic observations as well as for electrotherapeutic purposes. The coil is designed to operate on 220 volts, alternating current, and the frequency of the secondary current, it is claimed, is capable of variation up to one trillion oscillations per minute, while the secondary voltage may be made so great as to give rise to sparks several feet long. Owing to the nicety of the voltage and frequency adjustments, it is said that a Roentgen-ray tube can be so excited as to emit X-rays of extreme penetrating effect without burning or other injurious effects.

Simple Safety Rule Saves a Life.—John Bodefuhr, foreman of coal passers at the Northwest station of the Commonwealth Edison Company, Chicago, always checks up the men under him at the close of each shift to see that all are present. To the strict observance of this rule one of them undoubtedly owes his life. At the close of the day's work not long ago three coal passers were emptying a drop-bottom car when a damaged lever broke and precipitated one man backward into the coal-receiving hopper, where he was buried under coal. His absence was discovered when the foreman came to count the men, and on search being made Mr. Bodefuhr himself was the first to hear the injured man's groans. The victim was released by opening a gate in the hopper and allowing the man and the coal to slide out. Thus an accident which might have resulted fatally caused only slight injuries.

Diminishing Use of Platinum in the Electrical Industry.—Although platinum dishes and utensils and platinum "contact mass" are still used largely in chemical laboratories and in the chemical industries, the demand in the electrical industry for the heaviest of commercial metals is each year becoming less and less. In the manufacture of incandescent lamps a large quantity of platinum was formerly used, but at present wires made of nickel-chromium, metallic tungsten or metallic molybdenum are being substituted. The resistance wires of electric furnaces and heaters at one time contained considerable platinum, but metallic molybdenum has now to a considerable extent replaced the more expensive metal. Formerly the electrical ignition points of gas engines were made of platinum, but at present, it is believed, most of the spark-plug points used are made of metallic tungsten.

News of the Industry

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

Associations and Societies

Pittsburgh Contractors Have Social Evening.—Members of the Electrical Contractors' Association of Pittsburgh, Pa., were entertained with motion pictures, music and vaudeville at their annual dinner on Oct. 26 at the Fort Pitt Hotel. Several informal addresses were made during the course of the evening.

Chicago Section, I. E. S.—The November meeting of the Chicago Section of the Illuminating Engineering Society was held on Nov. 4 at the Edison Building. W. A. Durgin and J. B. Jackson presented a paper entitled "Semi-Direct Office Lighting in the Edison Building of Chicago." The paper included a demonstration of the fixtures in the Edison Building.

Philadelphia Section, I. E. S.—A meeting of the Philadelphia Section of the Illuminating Engineering Society will be held on Nov. 19 to hear a paper by R. E. Simpson, engineer of the Travelers' Insurance Company, entitled "Coal-Mine Illumination and Its Relation to Accident Prevention and Miner's Nystagmus." Robert B. Ely, 1000 Chestnut Street, Philadelphia, Pa., is secretary of the section.

Joint Convention of Independent Telephone Associations.—There will be a joint convention of the National Independent Telephone Association and the Independent Telephone Association of America at the Hotel LaSalle, Chicago, Ill., on Dec. 8, 9 and 10. It is thought by many prominent independent telephone men that the coming convention is a forerunner of the amalgamation of the two associations.

Spokane Section, A. I. E. E., Opens Season.—The first meeting of the fall and winter season of the Spokane (Wash.) Section of the American Institute of Electrical Engineers was held in the office building of the Washington Water Power Company on Oct. 15. Reports of delegates to the national convention and to the Pacific Coast convention were submitted and discussed. At the close of the meeting an electrically cooked supper was served.

Electrical Engineering Society of Columbia University.—At a meeting of the Electrical Engineering Society of Columbia University to be held in the School of Journalism, Columbia University, New York City, Nov. 23, at 8.15 p. m., Capt. C. E. Robinson of the Twenty-second Regiment of Engineers will give a talk on "The Work of the Military Engineer," with demonstrations by means of apparatus and motion pictures. The meeting is open to the public.

Report of A. S. M. E. Nominating Committee.—The nominating committee of the American Society of Mechanical Engineers has reported the following names as candidates for the offices indicated: President, D. S. Jacobus, New York; vice-presidents, William B. Jackson, Chicago, Ill.; J. Sellers Bancroft, Philadelphia; Julian Kennedy, Pittsburgh, Pa.; managers, John H. Barr, New York; John A. Stevens, Lowell, Mass., and H. de B. Parsons, New York; treasurer, William H. Wiley, New York.

Rochester Section, A. I. E. E.—The Rochester (N. Y.) Section of the American Institute of Electrical Engineers met at the Sibley Building on Oct. 22. Roger D. De Wolf spoke on "Design and Operation of an Electric Power Plant." It was announced that Prof. W. S. Franklin would speak at the next meeting on "The Mechanism and Analogies of Electricity." Mr. De Wolf discussed the size and efficiency of steam boilers used in connection with generating plants and explained new and special applications for boiler rooms.

November Meetings.—The following meetings will be held during November: Third annual Pennsylvania Industrial and Public Welfare and Engineering Conference, Nov. 16-18, Harrisburg, Pa.; Central Electric Association, Nov. 17, Indianapolis, Ind.; quarterly meeting of Electrical Supply Jobbers' Association, Nov. 17 and 19, Homestead Hotel, Hot Springs, Va.; Central Electric Railway Association, Nov. 18 and 19, Claypool Hotel, Indianapolis, Ind., and the Public Utilities Association of West Virginia, Nov. 18 and 19, White Sulphur Springs, W. Va.

Meeting of Electrical Supply Jobbers' Association.—The next regular meeting of the Electrical Supply Jobbers' Association will be held at Hot Springs, Va., Nov. 17, 18 and 19. The sessions of the first day will be devoted to association affairs. On the second day there will be an open session with addresses in the afternoon on "Co-operation" and "Fair Trade." The annual golf tournament will be held on Nov. 18, the manufacturers participating in the morning and the jobbers in the afternoon. Franklin Overbagh, 411 South Clinton Street, Chicago, is the general secretary of the association.

Dayton Jovians Hold Large Meeting.—More than 125 persons, including both local members and out-of-town guests, were present at the meeting of the Dayton Jovian League held on Oct. 25 in the Miami Hotel. The principal speaker was S. G. McMeen, president of the Ohio State Telephone Company. His address was on "Modern Telephoning." Thomas A. Wynne, vice-president of the Indianapolis Light & Heat Company and reigning Jupiter of the Jovian Order, read a paper on "Jovian Organization." Thomas J. Ryan, president of the Cincinnati Electrical Club, spoke on "A City and Its Jovian Club." A third visiting speaker was Statesman Carl Metz of Columbus.

Convention of Public Utilities Association of West Virginia.—The Public Utilities Association of West Virginia will meet in annual convention at White Sulphur Springs, W. Va., Nov. 18 and 19. The program contains the following papers of interest to electric light and power companies: "The Advisability of Central Stations Doing House Wiring," "Secondary Distribution and Method of Grounding Secondaries," "High-Tension Distribution," "Maximum-Demand Meters and Measurement," "Efficiency of Transformer Distribution," and "Diversity of Coal-Mining Load." In addition there will be a general discussion on public utility accounting. W. C. Davisson, Charleston, W. Va., is secretary-treasurer of the association.

Kansas City Jovian Club.—The following officers were elected at the annual meeting of the Jovian Electric Club in Kansas City, Mo., Nov. 2: President, H. F. Lang, Missouri & Kansas Telephone Company; vice-president, J. D. Todd, Western Electric Company; second vice-president, A. P. Denton, Denton Engineering & Construction Company; third vice-president, A. N. Richardson, general superintendent Kansas City Electric Light Company; fourth vice-president, W. S. Blue, Westinghouse Electric & Manufacturing Company; secretary and treasurer, C. W. McDaniel, Missouri & Kansas Telephone Company. The Jovian Electric Club, which now practically comprises the former electric club and the local Jovian League, is in the strongest position in its history, with a membership of about 210.

Convention of Alabama Light and Traction Association.—The Alabama Light and Traction Association held its convention at Montgomery, Ala., Oct. 20 and 21. F. H. Chamberlain of the Alabama Power Company, Birmingham, Ala., was elected president, and C. C. Henderson of the Henderson Light & Power Company, Greenville, Ala., was elected vice-president. The secretary and treasurer is J. P. Ross of the Birmingham Railway, Light & Power Company. Papers of interest to electrical men presented were as follows: "Merchandising Gas and Electricity," by Frank Hammond; "The Relation of the Company to Its Employees," by J. T. Hury; "The Relation of Accounts to Public Utility Operation," by V. B. Day; "High-Tension Outdoor Substations," by H. W. Young; "Taxation of Public Service Corporations," by T. K. Jackson; "Water-Power Development in Alabama," by T. W. Martin.

Annual Meeting of the A. S. M. E.—The annual meeting of the American Society of Mechanical Engineers will be held in New York from Dec. 7 to Dec. 10 inclusive. The first session will be held on the evening of Dec. 7, at which time there will be an address by the retiring president, John A. Brashaer, followed by a reception. Nine business and technical sessions are allotted for the following three days, at which a large number of papers and reports will be presented and discussed. At the professional session the following papers will be presented by title only with no opportunity for oral discussion: "Gas Producers with By-product Recovery," by Arthur H. Lynn; "The Application of Engineering Methods to the Problems of the Executive, Director and Trustee," by Hollis Godfrey; "Modern Electric Elevators and Elevator Problems," by David Lindquist; "Turbines Versus Engines in Units of Small Capacities," by J. S. Barstow; "The Connors Creek Plant of the Detroit Edison Company," by C. F. Hirshfeld; "Proportioning Chimneys on a Gas Basis," by A. L. Menzin. Among the papers to be presented of interest to electrical engineers and operating men are the following: "Design of Fire-Tube Boilers and Steam Drums," by F. W. Dean; "Higher Steam Pressures," by Robert Cramer; "A Novel Method of Handling Boilers to Prevent Corrosion and Scale," by Allen H. Babcock; "Electric Operation and Automatic Electric Control for Machine Tools," by L. C. Brooks; "The Heat-Insulating Properties of Commercial Steam-Pipe Covering," by L. B. McMillan; "Performance and Design of High-Vacuum-Surface Condensers," by G. H. Gibson and P. A. Bancel; "Circulation in Horizontal Water-Tube Boilers," by P. A. Bancel; "Unique Hydraulic Power Plant at the Henry Ford Farms," by M. A. Replogle; "Elasticity and Strength of Stoneware and Porcelain," by J. E. Boyd; "Oil-Engine Vaporizer Proportions," by Louis Illmer.

Public Service Commission News

Arizona Commission

Reductions in the rates for lighting and motor service in Tempe, Mesa and Chandler amounting on the average to 20 per cent were ordered by the Arizona Corporation Commission when an opinion in the South Side Gas & Electric Company case was handed down. The new rates are to be put into effect on or before Nov. 15.

A minimum rate of $1 per month for consumers of 7 kw.-hr. of lighting service during that period was prescribed by the commission. The rate per kilowatt-hour from 0 kw.-hr. to 10 kw.-hr. consumed is 14 cents; from 11 kw.-hr. to 100 kw.-hr. it is 13 cents, and it decreases 1 cent or 2 cents per 100 kw.-hr. or 200 kw.-hr. above that amount. Larger consumers of lighting service are to be served at lower rates, the rate above 1500 kw.-hr. being but 3 cents. Motor-service rates are also reduced by the order, the rates ranging from 8 cents for consumers of less than 100 kw.-hr. to 2.5 cents for consumers of 2000 kw.-hr. A minimum charge of $1 per month per horsepower installed for installation of more than 1 hp., and a minimum of $1 per month for 1 hp. or less, were provided for. The company is to meter all service not now measured. This case is one that has been before the commission for almost two years, and exhaustive investigations were made.

Georgia Commission

The Georgia Railroad Commission handed down a ruling recently against the Georgia Railway & Power Company of Atlanta denying it the right in all cases to require a deposit of $5 from each new customer for electricity before rendering service. The commission held that a deposit is reasonable only in cases where the new customer is unknown to the company, or is insolvent, or is known for his "litigious or contentious habits in regard to the payment of bills."

Iowa Commission

The Iowa Railroad Commission has ruled that electric companies seeking to secure franchises for the construction of high-tension power lines across the country and along the public highways must construct them so as not to damage the telephone lines already built along these highways. Few of the farmers' telephone lines have a metallic circuit, and their service is damaged by the proximity of high-tension wires.

Indiana Commission

The Public Service Commission of Indiana has just received the most important list of franchise surrenders, under the Indiana utility act, that it has accepted in any one list since its organization. The surrenders were made Nov. 6 by the Southern Telephone Company of Indiana, a corporation which very recently was authorized by the commission to take over the business of the former Cumberland Telephone & Telegraph Company, an Atlanta (Ga.) corporation. All the franchise surrenders were accepted, and an indeterminate permit was issued in each of fifty-three instances.

Massachusetts Commission

The Foster stock-ticker case has been referred to the full bench of the Massachusetts Supreme Court by Judge Pierce at Boston. The Public Service Commission recently issued an order requiring the Western Union Telegraph Company and the United Telegram Company to supply Calvin Foster of Boston with stock-ticker service, and the companies refused, contending that the board is without jurisdiction in view of the interstate character of the business, as well as on account of contractual relation between the companies and the New York Stock Exchange. Each party has petitioned the court for a finding in its favor.

New Jersey Commission

The Board of Public Utility Commissioners has issued an order suspending the proposed increase in rates to be made by the Wildwood Gas Company, which embodied a rule requiring each customer to pay $1 for having gas turned on and a similar charge for each customer using gas and ordering it discontinued and turned off. The board, holding that these charges will result in an increase in rates, suspends the new rule until Feb. 1, unless it shall determine in the meantime that the increase is just and reasonable.

New York Commissions

Volume IX of the Proceedings of the Public Service Commission for the First District of the State of New York has just been published. The volume contains the proceedings of the commission for the calendar year 1914.

Pennsylvania Commission

The Public Service Commission of the Commonwealth of Pennsylvania has handed down an order directing the Abington Electric Company to furnish electric service to a house and barn in Factoryville. It appeared from the testimony that the premises of the complainant are in the built-up portion of the borough, and although the company refused to supply the service on the ground that the expense would be out of all proportion to the return on the investment, the commission decided that service could be rendered without any great expense and indicated how it could be done. Commmenting on the case, the commission said: "We do not think that any public service company has the right to adopt a policy whereby it will serve only such customers as are remunerative at the time of installation. When a public service company secures a charter from the State and a franchise from a municipality in which it seeks to operate, it owes a duty to the public therein which it cannot perform by only serving such of the inhabitants thereof as it may, for reasons of its own, determine. We think it should make a reasonable effort and be compelled to serve all of the public in such municipality that can be reached by a reasonable outlay of its capital, and the service to be rendered to the public therein should be considered as a whole, and not from the individual standpoint of the profitable patrons only. That a public service company should have the right to pick out the profitable customers and leave all others without service would not, in our opinion, be rendering such public service as the law contemplates."

Wisconsin Commission

Volume XV of the opinions and decisions of the Railroad Commission of the State of Wisconsin, covering the period from Aug. 13, 1914, to Feb. 14, 1915, has just been published.

Corporate and Financial

Bristol Electric Light Company, Midland, Mich.—The company's plant has been purchased by the Consumers' Power Company, which will make changes and rebuild the Midland system, making extensions in several districts not now furnished. A transmission line will be constructed between Bay City and Midland to furnish hydroelectric energy from the Au Sable plant. The Midland property thus acquired will be operated as a component part of the Saginaw and Bay City districts of the Consumers' Power Company.

Commonwealth Edison Company, Chicago, Ill.—It is understood in Chicago financial circles that early next year the company will issue in the neighborhood of $4,500,000 of capital stock to be sold to present shareholders at par. The funds derived from the stock sale will be used to pay for a new turbine and for other improvements which the company is making.

Commonwealth Power, Railway & Light Company, Jackson, Mich.—The report of the companies embraced in the system, which operates in Michigan, Illinois, Indiana, Ohio and Wisconsin, for the month of September shows a gain of 3.1 per cent in gross earnings and of 23.3 per cent in surplus. The operating expenses, including taxes, were $17,201, or 2.5 per cent, less than during September, 1914. For the twelve months ended Sept. 30, 1915, the gross earnings amounted to $14,116,576, a gain of $28,150, while operating expenses and taxes were less than for the previous twelve months by $206,054. Net earnings were $6,589,558, as compared with $6,355,354 in the previous year, an increase of 3.7 per cent. An increase of $244,194, or 5.9 per cent, in interest, however, left a surplus of $2,222,608, which is a decrease of $9,990. The balance after dividends was $1,262,608. These figures exclude all inter-company earnings.

Consumers' Power Company, Owosso, Mich.—September earnings show an increase of 16 per cent in gross earnings, a decrease of 1.9 per cent in operating expenses and taxes, and a 63.1 per cent increase in surplus. Notwithstanding an increase of $12,033 in interest and $56,000 in preferred-stock dividends, the company was still able to show for the twelve months ended Sept. 30 a gain in the balance, after dividends on preferred stock, of $273,120, or 42.3 per cent. This balance is available for renewals, depreciation, financial requirements of the company, and common-stock dividends. The earnings reported for the twelve months ended Sept. 30, 1915, follow:

	1915	1914
Gross earnings	$3,684,179	$3,377,090
Operating expenses (including taxes)	1,502,795	1,536,859
Net earnings	$2,181,384	$1,840,231
Interest, etc.	864,818	852,785
Surplus	$1,316,566	$987,446
Preferred stock dividend	398,500	342,500
Balance	$918,066	$644,946

Cumberland County Power & Light Company, Portland, Me.—The company reports for the year ended Sept. 30 a balance available for renewals, depreciation, financial requirements and dividends on common stock of $190,696, or 9.9 per cent more than in the previous twelve months. The earnings statement for the twelve months ended Sept. 30, 1915, follows:

	1915	1914
Gross earnings	$2,586,678	$2,503,949
Operating expenses (including taxes)	1,475,987	1,429,718
Net earnings	$1,110,691	$1,074,231
Interest, etc.	781,995	762,788
Surplus	$328,696	$311,443
Preferred-stock dividends	138,000	138,000
Balance	$190,696	$173,443

Dayton (Ohio) Power & Light Company.—The report giving the results of September operations shows a decrease in the operating ratio for the month from 55.18 per cent in September, 1914, to 50.3 per cent in September of this year. For the twelve months ended Sept. 30, 1915, the operating ratio dropped from 56.47 per cent to 53.87 per cent. The gross earnings for the twelve months increased by 12 per cent. The surplus on hand on Sept. 30 was $144,479, as compared with $94,893 for the previous year. The earnings statement for the year ended Sept. 30 follows:

	1915	1914
Gross earnings	$1,025,109	$915,314
Operating expenses, including depreciation and taxes	552,210	516,841
Net earnings	$472,899	$398,473
Non-operating revenue	12,162	13,065
Total income	$485,061	$411,538
	1915	1914
Interest on bonds	$183,765	$180,343
Other interest and sinking fund	31,821	25,478
Total deductions	215,586	205,821
Net income	$269,475	$205,717
Dividend on preferred stock	124,996	110,824
Surplus	$144,479	$94,893

Great Western Power Company, San Francisco, Cal.—An issue of $4,500,000 of ten-year 6 per cent convertible debenture bonds has been sold to New York bankers subject to the approval of the California Railroad Commission. Proceeds of the bonds will be used to retire the $1,000,000 of 6 per cent notes of the Western Power Company, the parent company, due March 1, 1917, for the construction of a second high-tension transmission line, and for a third cable across San Francisco Bay, in order to provide for the substantial growth in the business of the company and particularly to handle several large contracts for power recently concluded. The debentures will soon be offered to stockholders of the Western Power Corporation.

New Hydroelectric Enterprise for Vermont.—The Vermont Public Service Commission gave a hearing at Middlebury on Nov. 12 upon petition of Charles H. Thompson of Montpelier, Robert L. Ryder of Boston, Mass., and others seeking to form a hydroelectric company to be known as the Central Power Corporation of Vermont, with offices at Middlebury, and to issue $1,000,000 in securities for the building, acquisition and operation of power plants, dams, reservoirs, etc., in East Middlebury, Brandon, Ripton and Salisbury.

Oro Electric Corporation, Oroville, Cal.—A qualified offer of $1,375,000 has been received from the Great Western Power Company for the public utility branch of the Oro Electric Corporation. The offer, if accepted, will be sufficient to pay off 75 per cent of the outstanding 6 per cent bonds of the corporation. The bondholders have been asked to give the corporation an option on their holdings until March, 1916, at 75 per cent of par value. Replies so far indicate that the bondholders are favorable to the proposition. More than $300,000 of bonds have been pledged to the plan, and a large number of important bondholders have signified their intention of participating by signing the option agreement. It is understood that the projected arrangement, by relieving the Oro company of its public utility feature, will tend materially to strengthen the company.

Uncas Power Company, Scotland, Conn.—Holders of 380 shares of the total outstanding and authorized 3000 shares of the company have filed in court a bill of complaint asking that a receiver be appointed for the company and that the corporation be dissolved.

Washington-Oregon Corporation, Vancouver, Wash.—The sale of the holdings of the corporation by the receiver which has been advertised for some time past and postponed from time to time was held in Chehalis Oct. 30, the property being taken over by Harry N. Putnam of Portland, Ore., representing Eastern bondholders of the organization, at $1,569,000. It is understood that the interests back of the purchaser will take over the entire holdings of the corporation under the name of the North Coast Power Company, the organization of which was recently perfected at Vancouver. The properties owned by the Washington-Oregon Corporation and which were sold include the electric interurban line between the cities of Centralia and Chehalis, the power plants at Chehalis and one on the Kalama River, and other auxiliary plants which the company operates in this section. The corporation owns or controls the electric light and power franchises in all the principal towns and villages on the Northern Pacific main line in southwestern Washington.

Manufacturing and Industrial

The Pratt Chuck Company, Frankfort, N. Y., manufacturer of conduit boxes, has recently purchased the electrical business of the Bossert Company, Utica, N. Y.

The General Insulate Company, Brooklyn, N. Y., has appointed as its agents the Dean Electric Company, 212 West Third Street, Los Angeles, Cal., and the P. Seiler Electric Works, 324 Market Street, San Francisco, Cal.

The Mohrlite Company has recently moved its plant from San Francisco, Cal., to Urbana, Ohio, where it has just opened a new factory. The company is making ornamental indirect lighting and semi-indirect lighting fixtures. W. M. Dixon is president of the concern, L. V. Korbel vice-president, and B. M. Smarr secretary.

Stove Manufacturer to Bring Out New Styles.—Five new types of electric ranges are to be brought out by the Globe Stove & Range Company of Kokomo, Ind., in the near future. With these models perfected the company expects to be able to offer to the trade a complete line of stoves, ranging in price from $25 to $500.

Silk City Electrical Supply Company, Paterson, N. J.—Under the firm name of the Silk City Electrical Supply Company, I. I. Jaffe, lately with the Baily Electrical Supply Company, and C. A. Kabat, formerly with the Independent Electrical Supply Company, have opened an electical supply house at 46 Broadway, Paterson, N. J.

The Safety-Armorite Conduit Company, Bailey-Farrell Building, Pittsburgh, Pa., has opened an office at 1670 Hudson Terminal Building, 50 Church Street, New York, which will be in charge of W. G. Campbell. Heretofore the company's products have been marketed in New York and vicinity by its selling representative, the Thomas & Betts Company.

The Menominee (Mich.) Electric Manufacturing Company, maker of motors, telephones and other electrical apparatus, has appointed the Kandem Electric Company, 49 East Twenty-first Street, New York, as its representative in New York and New Jersey. A complete stock of the Menominee electric company's goods will be maintained by the Kandem company.

The Lindsley Brothers Company, Minneapolis, Minn., dealer in Western red-cedar poles, Douglas-fir cross-arms, posts, etc., has opened an office in St. Louis, Mo. This office will be in charge of Frank O. Grayson and will be in the La Salle Building. Mr. Grayson will have charge of the territory included in Missouri, Kansas, Oklahoma, Arkansas, Louisiana, Tennessee and southern Illinois.

Brisk Demand for Small Generating Plants.—The Main Electric Manufacturing Company, 500 Aiken Avenue, Pittsburgh, Pa., reports that its business the past month has been exceptionally good, orders being received from all parts of the United States, from Canada and from Cuba. Two orders alone called for twenty-five outfits, each for a domestic concern. Another order from Cuba called for five plants.

French Holdings Bought by Aluminum Company of America.—It is reported that the Aluminum Company of America, Pittsburgh, Pa., has taken over the entire French holdings in a hydraulically operated aluminum plant near Whitney, N. C., which when completed was originally to have cost $10,000,000. Formal transfer of the properties, it is stated, took place last week, but no announcement has been made regarding the amount of money involved. Work was begun on the plant by the foreign interests early in 1914, but ceased soon after the war began. It is expected that the Aluminum Company of America will complete the plant as soon as possible.

W. R. Haynie, manager of the New York office at 30 Church Street of the Bolinders Company, Stockholm, Sweden, manufacturer of Diesel engines, sailed with Mrs. Haynie for Stockholm on the Kristianiafjord on Nov. 6. Mr. Haynie will be gone for about six weeks. He is making the trip with a view of increasing the facilities for delivering the marine oil engines in America, where the demand is increasing so rapidly that it is hard to keep up with deliveries. In view of the fact that the United States produces some 80 per cent of the oil of the world, Mr. Haynie declares that the market for oil engines in this country is exceptionally good and should prove more so in the future on account of the economies involved.

Los Angeles Electric Manufacturers' Plant Destroyed by Fire.—The plant of the United States Electrical Manufacturing Company, Los Angeles, Cal., maker of direct-current and alternating-current machinery, was recently destroyed by fire. Fortunately much of the loss is covered by insurance. Immediately after the fire temporary quarters were established, and in a few weeks the company expects to have a new factory with new equipment.

Boston Fixture House Busy.—Twenty-five large contracts for electric fixtures were filled last month by the McKenney & Waterbury Company of Boston, Mass., including ten in the city proper and the remainder in suburban and other New England points. Among the installations were the following: Trinity Church rectory, Boston; International Trust Company Building, Boston; Massachusetts Trust Company and other office buildings in Boston; Crawford House, Boston; Lombardy Inn, Boston; new Youth's Companion Building, Boston; Plymouth County Court House, Plymouth, Mass.; Dennison Manufacturing Company plant, Framingham, Mass.; Kernwood Country Club, Beverly, Mass.; Montpelier Savings Bank & Trust Company, Montpelier, Vt., and churches in Fall River, Dorchester and Revere, Mass. The Cambridge (Mass.) Board of Trade and the Waltham (Mass.) State School were also equipped with modern lighting fixtures by this house.

The Shaw-Kendall Engineering Company, Toledo, Ohio, manufacturer of pipe and steam goods, has recently taken over the plant of the Anderson Rolled Gear Company, Cleveland, Ohio. It is the intention of the Shaw-Kendall company eventually to manufacture at its plant both gears and the machines for rolling them; meanwhile, until preparations are completed it will utilize the factory formerly operated by the Anderson company. The company will make all types of finished gears, the teeth of which will be rolled instead of cut. In regard to its business in flange fittings, pipe and steam goods, W. M. Bellman, general manager of the Shaw-Kendall Engineering Company, states that there has been a marked improvement in the past few months as compared with the earlier months of the year. At the present time the company is working its plant overtime. One of the noticeable developments in the requirements of steam-power plants which Mr. Bellman directs attention to is the increasing size of material employed. There is a considerable demand for the largest sizes of pipe rolled by the mills, and Mr. Bellman believes that the day is not far distant when the pipe manufacturers will have to increase the size of pipe produced.

Standard Woven Fabric Company Purchases Walpole Plant.—The Standard Woven Fabric Company, Framingham, Mass., manufacturer of rubber goods, friction tapes, splicing compounds, "Multibestos" brake lining and clutch facings for automobiles, has recently bought the plant formerly operated by the Walpole Tire & Rubber Company at Walpole, Mass., and will take possession about Dec. 1. As noted in the ELECTRICAL WORLD of April 10, 1915, the company's department for manufacturing rubber goods is new, having been organized March 1, 1915. F. J. Gleason, formerly general superintendent for the Walpole Tire & Rubber Company, is in charge of this department. On account of the increased business in its rubber products and "Multibestos" goods, the company has been working its plant twenty-three hours a day. Until the opportunity of purchasing the Walpole plant presented itself the company had been contemplating building an addition to its Framingham factory. The increase of the Standard Woven Fabric Company's business has been quite large, and it is expected that the 1915 business will be 100 per cent greater than that of 1914. During the first six months of 1915 the company did as much business as in the entire twelve months of 1914. The officers of the company are: President, G. D. Moore; vice-president and general counsel, Stoughton Bell; treasurer and general manager, A. H. Burdick, and assistant treasurer, R. D. Northrup. The board of directors is composed of the above-named officers and W. L. Putnam, A. L. Carr, W. B. McSkimmon and J. H. Drury.

Denver to Push Ward Electric Trucks.—The Denver Gas & Electric Company has started a sales campaign with Ward electric trucks. Besides giving purchasers the option of paying for the truck within a year, no rental charge is made for the storage battery during the installment period. This is the first time that any competition with the gasoline truck has been undertaken in Denver on a large scale, and so far the company reports the plan as operating successfully.

Changes in Personnel of Westinghouse Company's Supply Department.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., announces a number of changes in its supply department, recently put into effect: S. A. Chase, formerly special representative; T. J. Pace, formerly in charge of the illuminating and rectifier divisions, and Carl C. Schluederberg, formerly head of switchboard sales, have been appointed assistants to the manager of the department, J. J. Gibson. C. E. Stephens, engineer of lighting, has been appointed manager of the illuminating section to succeed Mr. Pace. C. Streamer, formerly head of the order division, succeeds Mr. Schluederberg as manager of the switchboard section, and A. P. Joseph is appointed head of the order section to succeed Mr. Streamer. M. C. Morrow, formerly of the Philadelphia office, is appointed manager of the appliance section, which is a combination of the former heating, fan-motor and ozonizer divisions of the supply department. M. C. Rypinski, formerly manager of the detail and supply division of the New York office, becomes manager of the meter section. The power department, of which E. H. Sniffin is manager, also announces the appointment of the following section managers: W. H. Garrett, contracts; J. G. Worker, stokers, and H. D. Storer, auxiliaries.

NEW YORK METAL MARKET PRICES

	Nov. 3 Selling Prices Bid	Nov. 3 Selling Prices Asked	Nov. 9 Selling Prices Bid	Nov. 9 Selling Prices Asked
	£ s d	£ s d	£ s d	£ s d
London, standard spot	74 10 0		74 2 6	
Prime Lake	18.00	to 18.12½	18.00	to 18.25
Electrolytic	18.00	to 18.12½	18.00	to 18.25
Casting	17.50	to 17.75	17.50	to 17.75
Copper wire base	19.12½	to 19.37½†	19.25	to 19.50†
Lead	4.90		5.00	
Nickel	45.00	to 50.00†	45.00	to 50.00†
Sheet zinc, f.o.b. smelter	16.00†		16.50†	
Tin, Straits	36.00†		36.50†	
Aluminum, virgin, 99 per cent.	56.00	to 58.00†	56.00	to 58.00†

OLD METALS

Heavy copper and wire	15.00	to 15.25†	15.00	to 15.25†
Brass, heavy	10.00	to 10.25†	10.00	to 10.25†
Brass, light	8.50	to 9.00†	8.50	to 9.00†
Lead, heavy	4.25	to 4.35†	4.37½	to 4.47½†
Zinc, scrap	10.00	to 10.50†	10.50	to 11.00†

COPPER EXPORTS

Total tons to Nov. 9	4,588

†Nominal.

New Industrial Companies

The Service Electric Company, Chicago, Ill., has been incorporated with a capital stock of $6,000 by William F. Gresham, Ethel W. Downes and Douglas C. Gregg. The company intends to manufacture and deal in electrical and mechanical appliances.

The Absolute Contact Company, Chicago, Ill., has been chartered with a capital stock of $10 000 to manufacture and deal in electrical devices and appliances. The incorporators are Lester E. Goodman, Ralph F. Stern and Harold J. Goldberger.

The Fuller Company, Detroit, Mich., has been organized for the purpose of manufacturing an electric bus with two decks, which will be called the Fuller trackless electric car. Frank E. Kirby is president.

The Advance Battery & Manufacturing Company, Cincinnati, Ohio, has been incorporated by C. B. McCrea, C. L. Burnham, C. E. Ogden, A. Brandes and F. W. Farnsworth. The company is capitalized at $10,000 and proposes to manufacture and deal in electrical and mechanical appliances.

New Incorporations

The Delanson & Quaker Street Electric Light & Power Company, Duanesburg, N. Y., has been chartered with a capital stock of $5,000 by C. E. Washburn, E. V. Tompkins and F. W. Wilbur, Quaker Street.

The Allegany County Electric Light, Heat & Power Company, Wellsville, N. Y., has been incorporated with a capital stock of $25,000. The incorporators are J. Berger, B. Graham and C. H. C. Beakes, 206 East Twelfth Street, New York, N. Y.

The Gowanda Light & Power Corporation, Gowanda, N. Y., has filed articles of incorporation at Albany. The company is capitalized at $100,000 and intends to generate electricity for lamps, heaters and motors. The incorporators are G. M. Gest, 201 West 105th Street, New York; E. Wisnowski, 113 West Eighty-fourth Street, New York, and G. A. Larkin, Olean, N. Y.

Trade Publications

Lamp Guards.—Harvey Hubbell, Inc., Bridgeport, Conn., has prepared an illustrated folder which contains information on several types of lamp guards.

Electric Toys.—The Knapp Electric & Novelty Company, 511 West Fifty-first Street, New York, has published Catalog No. 25 on small motor-driven and battery-operated toys.

Electric Cooking.—The Globe Stove & Range Company of Kokomo, Ind., has issued an attractively decorated eight-page catalog setting forth the salient points on electric cooking.

Protective Devices.—The Condit Electrical Manufacturing Company, Boston, Mass., is sending out a number of its bulletins on protective equipment bound under one flexible cover.

Self-Contained Chain-Grate Stoker.—The Nosmoke Stoker Company, 90 West Street, New York, is sending out an illustrated booklet which describes a self-contained chain-grate stoker.

Ornamental Lighting Fixtures.—Catalog No. 18, recently published by Shapiro & Aronson, 20 Warren Street, New York, is very attractively illustrated and shows a large number of ornamental lighting fixtures.

Carbon Brushes.—The Calebough Self-Lubricating Carbon Company, 1503 Columbia Avenue, Philadelphia, Pa., has published a catalog which contains a large amount of information on its "no-spark" carbon brushes.

Electrically Operated Washer.—The American Woodenware Manufacturing Company, Toledo, Ohio, is sending out an illustrated bulletin which describes and illustrates several types of motor-driven washing machines.

Selling Helps.—The Hotpoint Electric Heating Company, Ontario, Cal., is sending out a booklet, designated as Form 895, which contains information on various kinds of selling help which the company is prepared to give to the dealers.

Mercury-Vapor Tubular Lamps.—The Cooper Hewitt Electric Company, Eighth and Grand Streets, Hoboken, N. J., has issued a reprint of an article which appeared in *Popular Electricity* and the *World's Advance*, entitled "A Light Which Beats Daylight."

Tungsten Lamps for Street Lighting.—The National Lamp Works of the General Electric Company, Cleveland, Ohio, have published Bulletin No. 11C, which contains considerable data on the use of their 100-cp. tungsten lamp for series street lighting. They are also sending out reprints of an article entitled "The Cleveland Lantern for Ornamental Lighting," by Ward Harrison, which appeared in the ELECTRICAL WORLD of Sept. 4, 1915.

Electrical Apparatus.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently issued the following sections of Catalog No. 3001: No. 259, on type I oil switches; No. 722, on type H direct-current flame carbon-arc lamps; No. 957, on types PM and PR portable alternating-current ammeters, types CO overload, CR reverse-power and CV voltage alternating-current meters; No. 1619, on type S distributing transformers; No. 1418, on type BD battery-charging panels.

Construction News

New England

FRANKLIN, N. H.—The City Council is considering the question of placing all wires underground on Central Street between the Sanborn and Daniell bridges, and also replacing the square poles now in use with round poles throughout the city.

MIDDLEBURY, VT.—The development of a water-power on the East Middlebury River, where it is estimated that 25,000 hp. can be developed, is under consideration by Charles H. Thompson, Montpelier, and others. A company to be known as the Central Power Corpn. of Vermont will be incorporated with a capital stock of $1,000,000 to carry out the project.

HOLYOKE, MASS.—The Board of Aldermen has authorized an issue of $100,000 in bonds, the proceeds to be used to enlarge and extend the municipal electric-light and gas plants. Improvements to the electric plant include the purchase of real estate, $8,000; underground conduit system, $22,500; air filter for turbine, $2,800; electrical apparatus, $4,000, and overhead extensions, $12,000.

NORTHFIELD, MASS.—A committee has been appointed to make investigations of electric light and power system, with a view of extending and improving the service. The Greenfield El. Lt. & Pwr. Co., Greenfield, furnishes energy in Northfield.

UPTON, MASS.—At a special town meeting held Nov. 3 the citizens voted to add 30 60-watt lamps to the street-lighting system. The new contract calls for 100 32-watt lamps and 30 60-watt lamps. The Worcester Suburban El. Co., Uxbridge, has the contract for street-lighting.

HARRISVILLE, R. I.—The Town Council has granted the Blackstone Valley Gas & El. Co., Woonsocket, a franchise to erect transmission lines in the villages of Oakland and Mapleville for the purpose of distributing electricity for domestic purposes.

GREENWICH, CONN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 10 for construction complete, including mechanical equipment and approaches, of the United States post office at Greenwich, Conn. Drawings and specifications may be obtained at the above office or from the custodian of site at Greenwich.

STAMFORD, CONN.—The Yale & Towne Mfg. Co., New York, N. Y., it is reported, is contemplating building an addition to the power house of its local plant.

Middle Atlantic

ANTWERP, N. Y.—The Antwerp Lt. & Pwr. Co. has nearly completed the erection of its transmission line to Sprague-ville, where it will supply electrical service. The company is also contemplating building a transmission line to Oxford in the near future.

EAST AURORA, N. Y.—The Public Service Commission has granted the East Aurora El. Lt. Co. permission to extend its system and supply electricity in the towns of Wales and Aurora.

MONTICELLO, N. Y.—The Murray El. Lt. & Pwr. Co., Monticello, has awarded a contract for extension of its transmission lines to Hurleyville. The Murray company is negotiating for right-of-way for a transmission line to Centerville on the south and to Woodbourne on the north.

NEW YORK, N. Y.—Bids will be received by Marcus M. Marks, borough president, Room 2032, Municipal Building, New York, until Dec. 1 for the construction of a building to be used as a court, a jail and a place of detention for women, to be situated at 135-141 West Thirtieth Street, borough of Manhattan. The work is to include general construction, plumbing, gas fitting, vacuum-cleaning system, refrigerating system, laundry equipment, heating and ventilating system, electrical work, elevator, dumb-waiter and lift equipment. Blank forms, specifications and plans may be obtained at the office of Griffin & Wynkoop, architects, 30 Church Street, New York.

SAVONA, N. Y.—Work preliminary to preparations of plans, etc., is under way by the Lamoka Pwr. Corpn., recently incorporated, for the purpose of utilizing the water of Little and Lamoka Lakes to develop about 9000 hp. under an effective head of 385 ft. Robert O. Hayt, Corning, N. Y., is consulting engineer.

BRACKENRIDGE, PA. — Preparations are being made for the installation of an electric-lighting system in Brackenridge. Electricity will be supplied by the municipal electric plant in Tarentum.

NEWMANSTOWN, PA.—The property of the Newmanstown El. Lt. & Pwr. Co. has been purchased by the Ephrata & Lebanon Lt. & Pwr. Co., recently organized. The latter is a subsidiary of the Ephrata & Lebanon Trac. Co., and it has also purchased the new transmission line recently erected by John Ware, Lancaster, which connects with the North Lancaster County El. Lt. & Pwr. Co. and supplies energy in Clay and Warwick Townships.

PHILADELPHIA, PA.—The board of education has decided to install complete electrical equipment in the Frankford High School and the Southern High School. J. Horace Cook is architect.

RIDGWAY, PA.—Extensive improvements involving an expenditure of about $15,000, it is reported, are under consideration by the Ridgway El. Lt. Co.

SHAMOKIN, PA.—Plans are being considered by the J. H. & C. K. Eagle Co. for the erection of several brick, steel and concrete silk mills, ranging in size from 25 ft. by 150 ft. to 60 ft. by 540 ft. The buildings, it is understood, will be equipped with electrically driven machinery.

SHIPPENSBURG, PA.—The Town Council is considering the installation of a new street-lighting system providing for the use of nitrogen-filled lamps. The present contract with the Shippensburg Gas & El. Co. expires Jan. 1, 1916.

TOPTON, PA.—A petition has been filed with the Borough Council asking for the installation of a municipal electric-light plant in Topton.

WEATHERLY, PA.—The directors of the Middle Coal Field Poor District have awarded the contract for the erection of an electric transmission line from Laurytown to Weatherly to Rodney D. Allen, Philadelphia, at $8,650.

ALLENHURST, N. J.—The Ocean County El. Co., recently incorporated with a capital stock of $525,000, is contemplating the construction of a dam across Toms River at Allenhurst. The power will be utilized to generate electricity for industrial purposes. F. Stanley Saurman, Churchville, Pa., is one of the incorporators.

LAMBERTVILLE, N. J.—The Lambertville Ht., Lt. & Pwr. Co. has been reorganized under the name of the Lambertville Pub. Ser. Co. Various improvements to the plant, it is reported, are under consideration by the new company.

MONTCLAIR, N. J.—Bids will be received by Frank J. Taylor, secretary of the Board of Education, Montclair, N. J., until Nov. 23 for alterations to the old high school building, now known as the Spaulding School, consisting of general construction, plumbing, heating and ventilating and electrical work. Separate bids will be received for the work. Drawings and specifications may be obtained from Starrett & Van Vleck, 8 West Fortieth Street, New York, N. Y., upon deposit of $10.

PATERSON, N. J.—The contract for installing the lighting and power plant in the high-school building has been awarded to Bennett & Brown, Paterson.

SPRING LAKE, N. J.—The Monmouth Hotel Co. is contemplating the erection of a large addition to its hotel in Spring Lake. Special attention will be given to the electrical equipment. Watson & Huckle, Philadelphia, Pa., are the architects.

STRATFORD, N. J.—The town authorities are considering a proposition submitted by the Clementon El. Lt. Co., Laurel Springs, for the installation of an electric-lighting system in Stratford.

TRENTON, N. J.—The Board of Commissioners has acquired a site on West Hanover Street on which to erect a new central fire-alarm and police-signal station.

TRENTON, N. J.—An appropriation has been voted by the City Commission for extensions and improvements to the city fire-alarm system and underground telegraph system.

TOWNSEND, DEL.—A company has been organized by local business men for the installation of an electric-light plant at Harmon's mill pond. George H. Wiggins, owner of the proposed site, is interested in the company.

BALTIMORE, MD.—The contract for the installation of the power plant and heating system for the four buildings composing the Johns Hopkins Medical School, of the Homeward group has been awarded to the Enterprise Steam & Hot Water Co., Baltimore, Md. Charles L. Reeder is consulting engineer.

BLACKSTONE, VA.—A franchise, it is reported, has been granted to C. E. Wilson, Crewe, for the installation of an electric-light plant in Blackstone.

HOPEWELL, VA.—Arrangements are being made by Stuart, James & Cooke, electrical and mechanical engineers, 50 Church Street, New York, N. Y., to install a distributing system in Hopewell. Energy will be purchased from the Petersburg & Appomattox Ry. Co. The service will be 2200 volts, 60 cycles, three-phase. Overhead-line material, transformers, meters and lamps will be required. M. T. Cooke of Stuart, James & Cooke, will have charge of the work. He will make his headquarters with reference to this work at 7 and 9 Main Street, Richmond, Va.

PETERSBURG, VA.—The Petersburg & Appomattox Ry. Co., Petersburg, has engaged Stuart, James & Cooke, 50 Church Street, New York, N. Y., to take charge of the engineering work of its proposed electric railway between Petersburg and Du Pont, a distance of 12 miles. Energy to operate the railway will be supplied by the Virginia Passenger & Pwr. Co. and will be converted through two rotary substations to 600 volts. The substations will have an output of 300 kw. and 400 kw. respectively. M. T. Cooke of Stuart, James & Cooke will have charge of the electrical work. His address in connection with this work will be care of the Vaughn Construction Co., Petersburg, Va.

WASHINGTON, D. C.—Bids will be received at the office of the purchasing agent, Post Office Department, Washington, D. C., until Nov. 15, for furnishing ten electric platform trucks.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., until Nov. 18 for furnishing two two-passenger automobiles for use in the fire department.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Nov. 23 for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 8967—15 40-wire connection boxes; Schedule 8954—50 seamless steel cylinders, 200 ft. miscellaneous steel tubing; Schedule 8962—200 bow lamps for motor boats, 125 shutter lanterns; Schedule 8964—miscellaneous plow-steel wire rope. Charleston, S. C., Schedule 8956—miscellaneous brass tubes. Mare Island, Cal., Schedule 8950—9420 lb., soft sheet copper; Schedule 8949—miscellaneous lenses and 22,800 lb. copper pipe. Applications for proposals should designate the schedule desired by number.

Enlarging Municipal Plant at Brookings, S. D.

The accompanying illustration shows the municipal electric-light plant in Brookings, S. D., with its new extension. The addition was built to provide space for more boilers, which will be equipped with mechanical stokers, and for a new high-speed, non-condensing engine. A new chimney 100 ft. high has been erected, as shown in the illustration. The smaller chimney will be torn down as soon as the new one is in use. Exhaust steam from the engines in this plant is used for heating the business and school buildings in the city of Brookings during the cold months. Brookings has a population of only about 4000, but it has had considerable publicity because of its successfully managed, municipally owned water-works, telephone, lighting, power and heating plants.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 19,002—The bureau is informed by an American consular officer in Siberia that a firm in his district desires the names and addresses of American manufacturers and exporters of visual teaching and laboratory accessories for schools, such as flasks, retorts, testing tubes, etc., for chemical study, physical apparatus for general mechanic, hydrostatic, optic, magnetic and electric work. Correspondence should be in Russian. No. 18,951—An American consular officer in Brazil reports that an engineer in that country desires to represent American manufacturers of electric vehicles, storage batteries and supplies for generating and utilizing electrical power (not light). No. 18,981—The bureau is informed by an American consular officer in Australia that a business man in his district deires to secure the sole agency for Amercan electrical appliances. No. 18,984—The bureau is informed by an American consular officer in India that a man in his district wishes to be supplied with catalogs, price lists, etc., of electrical goods with the intention of becoming the sole representative of an American firm. No. 18,988—An American consular officer in the Netherlands reports that a man in that country is interested in automobiles, electric apparatus, boat motors, motorcycles and supplies, typewriters, and new inventions in the technical line. It is stated that he desires to buy such goods for his own account and act as sole buying agent for Holland and colonies. No. 18,999—A commercial organization in the United States informs the bureau that a business man in Spain is interested in Martin Siemens soft steel plates for boilers, pipes and tools for boiler manufacturers, bases for boilers and hydraulic presses, and steam and water-cast iron turbines. Correspondence should be in Spanish. No. 19,099—The commercial attaché of the Department of Commerce in China writes that a firm in that country desires to establish connections with American manufacturers of electrical wires, fixtures, batteries and lamps of the cheaper class. No. 19,107—An American consular officer in the United Kingdom reports that a firm in his district is desirous of importing electric torches, particularly vulcanized torches complete with cup and lens, sizes 1¼ in. by 5 in., 1½ in. by 6½ in. and 1½ in. by 8½ in. Descriptive literature should be sent with quotations. No. 19,127—The bureau is informed that a man in Spain desires to represent American dealers in commercial chemicals, electrical supplies and mining machinery. No. 19,088—An American consular officer in Brazil writes that a man in his district desires to sell on commission for American firms hardware, electric lamps, dentists' supplies, etc. No. 19,141—A business firm in the United States writes that a firm in Portugal desires to represent American manufacturers of cartridges for hunting and to represent or buy for its own account electrical material. No. 19,144—An American consular officer in Argentina reports that a firm in his district desires to secure the representation of American manufacturers of narrow-gage (Decauville) railway material, steel structural material, concrete-mixing machines, steel cable and wire rope, brass trimmings and cabins for passenger elevators, derricks, cranes, excavating machinery, etc. Correspondence may be in Spanish or English. No. 19,147—An American consular officer in Denmark writes that a man in his district desires to represent American manufacturers of electrical goods. Correspondence may be in English. Further information may be obtained upon application to the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., and its branch offices.

North Central

RIVER ROUGE, MICH.—The Village Council is contemplating increasing the output of the municipal electric-lighting plant.

ROCHESTER, MICH.—The Western Knitting Mills are planning to install a plant to generate electricity used in the mills. Work has already begun on the construction of a large dam which will supply power to generate the energy needed.

BELLEFONTAINE, OHIO.—Bids will be received by the Board of Control, Bellefontaine, until Nov. 24 for furnishing and installing an ornamental lighting system in the business section of the city in accordance with plans and specifications on file in the office of the director of public service. Plans and specifications and bidding forms may be obtained from the director of public service, Bellefontaine, or from F. H. Froehlich, engineer, Second National Bank Building, Toledo, Ohio.

CANTON, OHIO.—Plans are being considered by the school board for the installation of the Gamewell fire-alarm system in a number of the older school buildings, with a view of covering all of the 23 buildings ultimately, at a total cost of $6,325.

CINCINNATI, OHIO.—The Sixth Street Business Men's Club has obtained the signatures of 82 per cent of the property holders on that thoroughfare, between Elm and Sycamore Streets, a distance of five blocks, to its petition for an ornamental lighting system, which is now practically assured.

GREENSPRING OHIO.—The Greenspring El. Lt. & Pwr. Co. has applied to the County Commissioners for a franchise to construct and operate an electric transmission line from Old Fort to Greenspring.

LIMA, OHIO.—At an election held recently the proposal to issue $60,000 in bonds for a municipal electric plant to maintain the ornamental street-lighting system was defeated.

NEWARK, OHIO.—Bonds to the amount of $30,000 have been authorized for the reconstruction of the municipal electric-light plant.

OTTAWA, OHIO.—The Northwestern Ohio Lt. Co., Van Wert, has applied to the State Public Utilities Commission for permission to purchase the property of the El. Lt. Co. of Ottawa.

PANDORA, OHIO.—Application has been made to the Public Utilities Commission by the Pandora El. Co. to take over the property of D. C. Shank & Co., Pandora. Both companies operate electric lighting and power plants in Pandora.

PERRYSVILLE, OHIO.—Bonds to the amount of $6,000 have been voted for the purchase of the local electric-light plant, to be owned and operated by the municipality.

WASHINGTON C. H., OHIO.—Notices are being issued to property owners by the city authorities for the purpose of assessing them for the proposed ornamental street-lighting system, on which work will soon begin.

PERRYVILLE, KY.—The local electric-light and ice plant, owned by W. J. Debaun, has been purchased by Russell Brothers of Washington County.

OLDENBURG, IND.—Bids are being received for the construction of a power house at the convent of the Sisters of St. Francis, Oldenburg, to cost about $20,000. J. J. Reuckert, Allen Building, Cincinnati, Ohio, is architect.

BELLEVILLE, ILL.—The installation of a municipal electric-lighting plant in Belleville is under consideration by the City Council.

CHICAGO, ILL.—The United States Ball Bearing Co., 2147 North Kolmar Avenue, Chicago, it is reported, is contemplating the construction of a power house, to cost about $15,000.

GALESBURG, ILL.—Bonds to the amount of $95,000 have been voted for improvements to the municipal electric-light plant and water-works system.

NEW HOLLAND, ILL.—The New Holland Lt. & Pwr. Co. has applied to the State Public Utilities Commission for a certificate of convenience and necessity to erect a transmission line from Mason City to New Holland.

ROCK FALLS, ILL.—An election will be held Nov. 16 to submit to the voters the proposal to issue $5,000 in bonds for improvements to the municipal electric-light plant.

LYONS, WIS.—The installation of an electric-lighting system in Lyons is under consideration. Energy, it is understood, will be secured from the Island Woolen Mills power plant.

MADISON, WIS.—The Wisconsin River Pwr. Co., Madison, is reported to be contemplating the erection of transmission lines in Sauk, Dane and Columbia Counties.

BOVEY, MINN.—The local electric-light plant, recently destroyed by fire, will be rebuilt at once. For further information address the town clerk.

BRAINERD, MINN.—The Pub. Ser. Co. of St. Cloud, it is reported, has begun work on the erection of a new power plant in Brainerd. A. G. Whitney is president.

MINNEAPOLIS, MINN.—The West Side Commercial Club of Minneapolis is contemplating the installation of an ornamental lighting system. Energy to maintain it will be supplied by the Minneapolis General Electric Co.

ORTONVILLE, MINN.—Bids will be received at the office of the Board of Education, Ortonville, until Dec. 4 for construction complete of a high-school building. Proposals will also be received at the same time for plumbing, heating and ventilating and electrical work. Plans and specifications may be obtained upon application to E. F. Broomhall, architect, Alworth Building, Duluth, for which a deposit of $50 will be required. Plans and specifications are on file in the Northwest Builders' Exhibit, Minneapolis; at the office of the board of education, Ortonville, and at the office of the architect.

RAYMOND, MINN.—The village of Raymind has voted to issue $5,000 in bonds, the proceeds to be used for the installation of a distributing system, including switchboards, transformers, etc. Energy to operate the system will be secured from the Minnesota Valley Lt. & Pwr. Co., Montevideo. As yet an engineer has not been employed. H. E. Day is village recorder.

ROCHESTER, MINN.—The municipal electric-lighting plant was destroyed by fire on Oct. 30, causing a loss of about $125,000.

KANAWHA, IOWA.—The City Council has engaged J. B. Hill, consulting engineer, Iowa City, to take charge of the engineering work in connection with the proposed municipal electric-lighting plant. Contracts for construction of plant, it is understood, have been awarded.

KEOKUK, IOWA.—Preparations are being made by the Keokuk Electro-Metals Co., Keokuk, for the construction of a large plant in Ford's Addition, to cost about $90,000. The plant will be equipped with electrical furnaces, motors, etc. Energy will be obtained from the power plant on the Mississippi River. G. R. Weissenburger, New York, N. Y., is interested in the company.

LIME SPRINGS, IOWA.—The local electric-light plant and mill, formerly owned by William Freuchte, have been purchased by D. W. Davis.

MARENGO, IOWA.—Application has been made to the State Board of Railroad Commissioners by the Iowa El. Co., Marengo, for a franchise to erect and operate an electric transmission line from Marengo to Victor. The company is also planning to extend its transmission line from Cedar Rapids to Boone, taking in Baxter. The company has also filed a petition with the State Railroad Commission for a franchise to erect a transmission line from Calamus via Grand Mound to De Witt.

MUSCATINE, IOWA.—The Montezuma branch of the Rock Island Railroad, it is reported, will be equipped for electrical operation. A company with a capital stock of $350,000 has been organized under the name of the Muscatine & Iowa City R. R. Co., to equip and operate the railway. The railway is about 150 miles long.

TIPTON, IOWA.—Arrangements are being made by the City Council to take over the local electric-light plant Jan. 1, 1916, to be owned and operated by the municipality.

CRANE, MO.—A local company, it is reported, is being organized to install an electric plant to supply electricity for street and domestic lighting. Energy to maintain the system will be purchased from the Ozark Pwr. & Lt. Co., Ozark.

KANSAS CITY, MO.—The Kansas City Radiator Co., recently incorporated, is building a plant on the Roanoke Road, to be equipped with electrically driven machinery, using about 250 hp. on 20 motors. The plans provide for Westinghouse equipment for three-phase, 25-cycle service.

KANSAS CITY, MO.—The new plant of the Campbell Baking Co., Thirtieth Street and Frost Avenue, which will soon be put in operation, will be equipped with motor-driven machinery, using about 150 hp. in motors. The company will operate about 40 electric trucks, maintaining a motor-generator set for charging purposes.

KANSAS CITY, MO.—The new building of the Ridenour-Baker Grocery Co., Kansas City, now under construction, will be equipped with electrically driven machinery (probably with motors mounted on machines). The electrical equipment, it is understood, has not yet been purchased. The company now has a charging station for its electric trucks, which will continue in service.

NEW MADRID, MO.—Bids will be received by W. H. Copeland, city clerk, New Madrid, until Nov. 29 for additions to the municipal electric-light plant. H. H. Humphrey, Chemical Building, St. Louis, Mo., is consulting engineer.

EMERY, S. D.—The Bridgewater El. Pwr. Co., Bridgewater, which was recently granted a franchise to supply electrical service in Emery, is now installing a distributing system here. Energy for operating the system will be supplied from the Bridgewater plant.

MARION, S. D.—The installation of an electric-lighting system in Marion is under consideration by local business men.

DUBOIS, NEB.—The city of Dubois has awarded the contract for the erection of an electric transmission line between Paw-

nee City and Dubois to the Korsemeyer Co., Lincoln.

LINCOLN, NEB.—The city of Lincoln would like to receive prices and catalogs for apparatus for the installation of a complete oiling system and a coal dump in the power house of the municipal electric light and water-works plant. A new shop building is under construction at the present time, and a complete up-to-date machine shop equipment, including one or more large directly connected motor-driven lathes, will be required.

LAWRENCE, KAN.—The Lawrence Ry. & Lt. Co. has submitted proposals to the towns of Perry and Eudora to supply electrical service in those places.

LITTLE RIVER, KAN.—Plans are being prepared by W. B. Rollins & Co., Midland Building, Kansas City, Mo., for a municipal electric plant in Little River, to cost about $16,000.

OAKLAND, KAN.—A committee has been appointed to enter into negotiations with the Topeka Edison Co., Topeka, for lighting the entire city. The plans for street lighting provide for about 80 lamps.

Southern States

GASTONIA, N. C.—Contracts have been awarded for the installation of an ornamental street-lighting system in the business district, for which $6,000 has been appropriated. The plans provide for 63 standards each mounted with one 600-cp lamp.

STANTONSBURG, N. C.—The contract for the installation of the proposed municial electric-light plant has been awarded to Fairbanks, Morse & Co., Atlanta, Ga.

GAFFNEY, S. C.—The installation of an ornamental lighting system in the business district is under consideration.

HOMESTEAD, FLA.—Bonds to the amount of $40,000 have been voted for the installation of an electric-light plant and other municipal improvements.

WINTER HAVEN, FLA.—The Winter Haven Wtr., Ice & Lt. Co. has awarded contract for the construction of a power house and machine-shop annex to the Steel Products Co., 232 East Broad Street, Savannah, Ga.

FAIRHOPE, ALA.—The city of Fairhope is planning to install a municipal electric-light plant, to develop from 50 hp. to 75 hp., at a cost of about $10,000.

WESSON, MISS.—Bonds to the amount of $18,000 have been authorized by the City Council for the installation of a municipal electric-light plant and water-works system. Bids will be received until Dec. 7 for construction of the proposed plants.

NEWPORT, ARK.—The Arkansas Lt. & Pwr. Co., Newport, is contemplating the erection of an electric transmission line from Newport to Tuckerman.

OPELOUSAS, LA.—The municipal electric-light and water plant was damaged by fire recently, causing a loss of about $5,000.

EL CAMPO, TEX.—The installation of an electric street-lighting system in El Campo is under consideration.

PORT ARTHUR, TEX.—The Port Arthur Gas & El. Co., recently organized, is planning to install an electric light and power plant in Port Arthur. J. S. Connelly, S. B. Redmond and others are interested in the company.

RIO GRANDE, TEX.—The Rio Grande City Ice, Wtr. & Lt. Co., recently organized, is contemplating the construction of a water and light plant and ice factory. R. R. Margo is interested in the project.

SAN ANTONIO, TEX.—Arrangements have been made by the property owners on Commerce Street between Soledad Street and Santa Rosa Avenue with the San Antonio Gas & El. Co. for the installation of ornamental lamps on that section of the thoroughfare. The system, including underground wires, will be installed by the San Antonio company.

TEMPLE, TEX.—The Water Commissioners are reported to be considering the installation of an electric-motor-driven pump at the city pumping station, to cost about $6000.

Pacific States

ELLENSBURG, WASH.—The City Council is considering improvements to the municipal electric power plant, involving an expenditure of about $60,000.

PALOUSE, WASH.—Initial steps have been taken by the City Council toward a municipally owned electric plant. The franchise granted the Palouse Lt. & Pwr. Co., now held by the Washington Wtr. Pwr. Co., Spokane, expires this fall, and under its provisions the city has the privilege of taking over the property any time during the next 12 months. The Council has authorized City Attorney McCroskey and members of the committee on public utilities to make investigations and report to the Council, with a view of calling a special election for the purpose of voting on an issue of bonds for the purchase and improvement of the plant.

SEATTLE, WASH.—The Board of Public Works has awarded the contract for a year's supply of incandescent lamps for the city lighting department to the Pacific Lamp & Supply Co., Seattle. The contract calls for the delivery of about $80,000 worth of lamps.

SEATTLE, WASH.—Mayor H. C. Gill, after vetoing the Council bill which provided for the appropriation of $25,000 to be used for the purpose of sealing the leaky impounding basin at Cedar Falls, has recommended that steps be taken to construct a power plant at Landsburg, 12 miles from Cedar Falls, where it is asserted that between 40,000 kw. and 60,000 kw. can be developed and could be made available before the impounding basin at Cedar Falls can be sealed and made ready.

TACOMA, WASH.—B. W. Collins, superintendent of the municipal electric-light plant, has awarded the contract for electric lamps, amounting to about $10,000, to the Home El. Co., Tacoma. The lamps will be supplied by the General Electric Co.

PILOT ROCK, ORE.—Application has been made to the Council by L. K. Harlan for a franchise to install an electric-lighting plant in Pilot Rock. Mr. Harlan proposes to remove an electric plant from Lexington here.

FORT MASON, CAL.—Bids will be received at the office of the constructing quartermaster, Fort Mason, Cal., until Nov. 24 for construction, including plumbing, heating and lighting, of addition to nurses' dormitory, Letterman Hospital.

SAN FRANCISCO, CAL.—The Great Western Pwr. Co., San Francisco, has sold $4,500,000 in convertible debenture bonds, subject to the approval of the State Railroad Commission, of which the proceeds of $1,000,000 will be used to retire outstanding notes and the remainder for erecting a second high-tension transmission line and laying a third cable across San Francisco Bay, to provide for the growth in general business of the company and particularly to handle several large contracts recently concluded.

SAN FRANCISCO, CAL.—The Pacific Gas & El. Co., San Francisco, it is reported, is making preparations to resume construction work in eastern Placer County. The first work to be done will be the installation of two power houses, with a maximum output of 10,000 hp. each, which will be known as No. 4 and No. 5. They will be situated between Colfax and Auburn; No. 4 is near Clipper Gap and No. 5 near Auburn. The construction of these two additional power plants requires 10,000 ft. of tunneling, of which 4000 ft. has been done. The company is also planning to complete its high-tension transmission line from Cordelia to San Rafael and thence to a point on the opposite side of the Golden Gate, from which cables will be laid under the bay to connect with the transmission lines now extending throughout the Exposition.

EMMETT, IDAHO.—The Electric Investment Co., Boise, it is reported, is contemplating rebuilding its electric light and power lines in Emmett, work to begin in the near future.

KELLOGG, IDAHO.—Arrangements are being made by the Washington Wtr. Pwr. Co., Spokane, to extend its transmission lines to the Constitution and Little Pittsburg mines, on Pine Creek, near Kellogg. The company has already extended its service to several mining properties in this vicinity, and other mining companies contemplate using electricity to operate their stamp mills.

VICTOR, IDAHO.—Bonds to the amount of $4,000 have been authorized for the installation of an electric-lighting system in Victor.

SALT LAKE CITY, UTAH.—Plans have been completed by the city engineer for lighting district No. 1, to be established in the business district of the city. These provide for the erection of seven flaming-arc lamps in each block on both sides of the street, the lamps to be suspended from ornamental arms attached to the sidewalk standards. The cost of installation and maintenance for a period of three years is placed at $33,984.

CHOTEAU, MONT.—The City Council is considering the installation of an ornamental street-lighting system. The plans provide for the erection of 100-watt lamps with reflectors in the residence district and of ornamental lamp standards in the business portion of the town.

HEDGESVILLE, MONT.—Plans are being considered for the installation of an electric street-lighting system and water-works.

RYEGATE, MONT.—The installation of an electric-lighting system in Ryegate is reported to be under consideration.

GOLDEN, COL.—The Jefferson County Pwr. & Lt. Co., Golden, is contemplating erecting a 10,000-volt transmission line to Morrison, a distance of 8 miles, and installing a distributing system in that town. Work on the proposed line will probably start early in the spring of 1916.

Canada

RESTON, MAN.—The Town Council has awarded the Accumulator Ltg. Co., Winnipeg, a contract for the installation of an electric generating plant and distribution system in Reston.

DOON, ONT.—The Preston Hydro Co., Preston, is contemplating the installation of an electric-lighting system in Doon.

TORONTO, ONT.—The Toronto Electric Commissioners would like to receive tenders for overhead-line construction work. Particulars may be obtained on application to the purchasing or engineering department, 15 Wilton Avenue, Toronto. W. C. Busch is purchasing agent. For details see proposal columns.

WELLAND, ONT.—At an election held Nov. 3 the by-law authorizing the purchase of energy from the Ontario Hydro-Electric Power Commission and for an issue of $14,000 in debentures to purchase machinery and equipment for the municipal electric-light plant was carried.

WESTON, ONT.—Plans have been completed by the Weston Water, Power and Light Commission for the extension of the local hydroelectric system to Thistledown. The scheme has received the approval of the Etobicoke Township Council, and work will start in the near future.

MONTREAL, QUE.—The stockholders of the Laurentide Company have approved the action taken by the directors to segregate the new power development from the paper department by organizing the Laurentide Pwr. Co. The new company is capitalized at $10,500,000, and all assets and accessories of the hydraulic enterprise will be transferred to the new company. The head office of the Laurentide Pwr. Co. will be in Montreal.

ST. JOHN'S, QUE.—Tenders will soon be asked for the installation of a lighting system on the Richelieu Bridge between the municipalities of Iberville and St. John's.

WARWICK, QUE.—The Town Council is negotiating with the Athabasca Wtr. & Pwr. Co., Victoriaville, for the installation of electric-lighting and water systems in Warwick.

DAWSON, Y. T.—The large steam generating plant of the Canadian Klondike Mining Co., used for driving dredges, heating the company's shops and the general works, was burned on Oct. 29. A battery of three large water-cooled tubular boilers and a 400-kw. turbine were destroyed. The plant, it is reported, will be rebuilt at an early date on an enlarged scale.

Miscellaneous

PEARL HARBOR, HAWAII.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 27, for constructing one reinforced-concrete power house, one reinforced-concrete operating building, and one wooden double quarters for chief operators at the naval station, Pearl Harbor. Plans and specifications may be obtained on application to the bureau or to the commandant of the naval station named.

CAVITE, P. I.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 4, 1916, for constructing five buildings, including a power house and operating building of reinforced-concrete and steel construction and three quarters of wood construction, for commanding officer, married operators and bachelor operators at the naval station at Cavite, P. I. Plans and specifications may be obtained on application to the bureau or to the commandant of the naval station named.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 2, 1915.

[Prepared by Mitchell & Allyn, 41 Park Row, New York.]

1,158,426. Electric Switch; F. Barr, New York, N. Y. App. filed May 10, 1915. Ratchet-operated snap switch with indicator.

1,158,427. Electric Switch; F. Barr, New York, N. Y. App. filed Oct. 27, 1914. Spring throws switch irrespective of slow pull on pull chain.

1,158,428. Pull Switch; F. Barr, Woodhaven, N. Y. App. filed April 14, 1915. Loose spindle and special movable switch member.

1,158,441. Rectifier System; D. E. Carpenter, Wilkinsburg, Pa. App. filed Feb. 19, 1914. Large capacity, with indicator to show condition.

1,158,451. Electrical Hot-Plate; R. W. Davenport, Detroit, Mich. App. filed Oct. 10, 1914. Has substantial support with minimum loss of heat.

1,158,474. System of Current Rectification; C. Le. G. Fortescue, Pittsburgh, Pa. App. filed June 21, 1912. Polyphase; prevents local circulating currents.

1,158,475. Self-Serving Table and Heater; W. J. Fox, San Diego, Cal. App. filed Feb. 19, 1915. Rotary table-top with heaters.

1,158,486. Electrically Heated Boiler; W. S. Hadaway, Jr., East Orange, N. J., and E. E. Rose, Swissvale, Pa. App. filed Feb. 11, 1910. For use on electric trains for heating.

1,158,487. Resistance Element; W. S. Hadaway, Jr., East Orange, N. J. App. filed June 25, 1910. For sadirons.

1,158,488. Electrical Apparatus; W. S. Hadaway, Jr., New Rochelle, N. Y., and E. E. Rose, Swissvale, Pa. App. filed Feb. 11, 1910. Immersion heater.

1,158,491. Secondary-Battery Element; E. Handler, Baltimore, Md. App. filed May 2, 1913. Active material made uniformly active.

1,158,492. Circuit Interrupter; F. W. Harris, Wilkinsburg, Pa. App. filed June 17, 1910. Oil-immersed type.

1,158,495. Induction Motor; R. E. Hellmund, Pittsburgh, Pa. App. filed June 28, 1911. Ventilating-core structure.

1,158,511. Polyphase Synchronous Motor; B. G. Lamme, Pittsburgh, Pa. App. filed Jan. 7, 1911. Self-starting feature

1,158,512. Two-Speed Induction-Motor Winding; B. G. Lamme, Pittsburgh, Pa. App. filed Jan. 24, 1914. For operation at more than one speed.

1,158,516. Electrode for Arc Lamps; G. M. Little, Pittsburgh, and B. J. Gudge, Wilkinsburg, Pa. App. filed May 22, 1911. Refractory material with metallic end tip.

1,158,534. Switch Box; T. E. Murray, New York, N. Y. App. filed Dec. 22, 1914. Spring-pressed switch member slides in wall of the box.

1,158,535. Cut-Out Switch; T. E. Murray, New York, N. Y. App. filed Dec. 22, 1914. Cartridge fuse carried by pivoted support.

1,158,539. Electric Immersion Heater; H. A. Newcomb, Wilkinsburg, Pa. App. filed April 6, 1915. Current interrupted when withdrawn from liquid.

1,158,543. Electric Drill; R. A. Norling, Aurora, Ill. App. filed Sept. 18, 1913. Portable construction.

1,158,557. Electrically Heated Implement; E. E. Rose, Swissvale, Pa. App. filed July 17, 1912. Sadiron with special heating unit.

1,158,565. Induction Meter; G. A. Scheeffer, Indianapolis, Ind. App. filed Aug. 10, 1911. Readily adjusted and repaired.

1,158,572. Electrical-Resistance Device; A. Simon, Milwaukee, Wis. App. filed May 14, 1910. Dissipates part of the heat by radiation.

1,158,578. Dash and Trouble Lamp for Automobiles; J. C. Stearns, Worcester, Mass. App. filed March 18, 1914. Has special means to prevent disconnection.

1,158,586. Electric-Heating Apparatus; F. Thornton, Jr., Pittsburgh, Pa. App. filed June 5, 1913. Instantaneous liquid heater.

1,158,598. Commutating Device for Dynamo-Electric Machines; M. Walker, Hale, England. App. filed Nov. 30, 1910. Commutating pawl has greater than ordinary number of turns.

1,158,620. Horn for Automobiles and Motorcycles; S. A. Beyland, North Ridgeville, Ohio. App. filed Oct. 8, 1913. Constructed particularly for motorcycles.

1,158,636. Telephone System and Individual Transmitter Therefor; C. L. Chisholm, Marysville, N. B., Canada. App. filed March 21, 1910. Carried in watchcase and readily applied to telephone instrument.

1,158,665. Electric Telegraph Apparatus; J. A. Elms, Somerville, Mass. App. filed Oct. 30, 1912. Multiplex includes polarized and neutral relays.

1,158,682. Electric-Motor Time Controller; C. I. Hall, Chicago, Ill. App. filed Oct. 10, 1911. For indicating maximum consumption.

1,158,698. Irreversible Mechanism; A. Loomis, Detroit, Mich. App. filed Dec. 31, 1910. Coupling between magneto and its driving shaft and the spark-advance mechanism.

1,158,708. Electric-Circuit Connector; W. P. Mulligan, St. Paul, Minn. App. filed Jan. 19, 1914. For railway trains.

1,158,723. Electric, Steam and Hot-Water Radiator; J. D. Ross, Portland, Me. App. filed March 14, 1914. Insertible in the conduit, connecting a series of radiating sections.

1,158,724. Electric Radiator; J. D. Ross, Portland, Me. App. filed Sept. 30, 1914. Special circulating arrangement.

1,158,729. Automatic Circuit Maker and Breaker; M. Scholl, Houston, Tex. App. filed June 5, 1914. Operated by clock.

1,158,742. Fire-Alarm Box; N. H. Suren, Needham, Mass. App. filed March 7, 1912. Non-interference type.

1,158,749. Electric Switch; A. A. Tirrill, Pittsburgh, Pa. App. filed March 28, 1912. Push-button, flush type with indicator.

1,158,762. Ignition Apparatus for Explosion Engines; F. B. Williams, Monroe, Mich. App. filed May 2, 1913. Automatic spark advance and retard.

1,158,810. Inductance Coil for Telephone Lines; S. B. Kent, New York, N. Y. App. filed Sept. 12, 1914. Loading coil with discontinuance core.

1,158,820. Speed-Limiting Device; A. J. Loudin, Norwood, Ohio. App. filed Nov. 20, 1912. Disconnects machines at danger speed.

1,158,821. Railway-Signal Recording Device; N. and W. E. Lombard, Arlington, Mass. App. filed Feb. 8, 1904. Record obtained of the train movements.

1,158,824. Mechanism for Raising and Lowering Shutters or Curtains; E. H. McCloud, Columbus, Ohio. App. filed March 4, 1908. Electrically operated rolling shutter or curtain.

1,158,834. Vibratory - Electric - Bath Blanket; H. D. Parker, Buffalo, N. Y. App. filed Oct. 21, 1914. Uses alternating current.

1,158,842. Protecting Device for Vapor-Electric Apparatus; J. C. Pole, New York, N. Y. App. filed Nov. 13, 1912. Includes a pivoted permanent magnet.

1,158,894. Battery Well; C. A. Christofferson and W. M. McClintock, St. Paul, Minn. App. filed Dec. 8, 1913. Constructed to withstand lateral pressure.

1,158,896. Protected Electric Service Cut-Out; R. C. Cole, Hartford, Conn. App. filed Oct. 26, 1914. Inclosed cut-out switch.

1,158,898. Electrically Operated Device; F. Conrad, Swissvale, Pa. App. filed Sept. 20, 1906. Alternating-current railway signal.

1,158,899. Electric Furnace Intended Chiefly for the Manufacture of Nitrides. J. Coutagne, Lyons, France. App. filed May 21, 1914. Has tubular electrode block.

1,158,927. Automatic Telephone System; W. Kaisling, Chicago, Ill. App. filed May 16, 1910. Two-wire metallic system.

1,158,928. Terminal for Mercury-Vapor Apparatus; F. G. Keyes, East Orange, N. J. App. filed Jan. 8, 1914. For quartz lamps.

1,158,930. Terminal Clip for Electrical Conductors; A. Klinger, New York, N. Y. App. filed Nov. 14, 1912. May be frictionally or positively engaged with the terminal screw.

1,158,951. Impulse-Producing Mechanism; A. H. Adams and H. Pfannenstfehl, Antwerp, Belgium. App. filed Aug. 19, 1914. Dial sender for automatic telephone.

1,158,954. Electrical Indicating and Regulating Apparatus; V. G. Apple and G. B. Sayre, Dayton, Ohio. App. filed Oct. 6, 1913. For automobile lighting system.

1,158,955. Switch; V. G. Apple and W. M. S. Miller, Dayton, Ohio. App. filed Nov. 19, 1914. For gas-engine electric starter.

1,158,967. Means for Detecting the Presence at a Distance of Icebergs, Steamships, and Other Cold or Hot Objects; L. Bellingham, Tunbridge Wells, Eng. App. filed May 1, 1913. Radiation receiver sensitive to infra-red wave-lengths.

1,158,971. Electric Furnace; P. A. Boeck, Worcester, Mass. App. filed Nov. 2, 1911. Cup-shaped core-supporting resistance element.

1,158,972. Electric Furnace; P. A. Boeck, Worcester, Mass. App. filed Nov. 2, 1911. Tube furnace.

1,158,988. Electrical Musical Instrument; J. C. Deagan, Chicago, Ill. App. filed May 12, 1913. Bells and electromagnets.

1,158,997. Arc-Lamp Electrode; C. Field, 3d, Lakewood, Ohio. App. filed Aug. 8, 1913. Potassium and zirconium fluorides.

1,159,021. Storage Battery; H. S. Hawkins, A. M. Green and I. W. Gibbins, Alturas, Cal. App. filed March 7, 1914. Has increased exposed surface.

1,159,035. Storage-Battery Grid; W. S. Hutchinson, Montreal, Canada. App. filed July 16, 1913. Active material forms a continuous mass.

1,159,040. Electrical Distribution; N. Joleen, Chicago, Ill. App. filed May 28, 1914. For maintaining fairly constant load.

1,159,074. Safety Device for Elevators; O. I. Nigh, Washington, D. C. App. filed Nov. 4, 1913. Installed on opposite side of car from starting mechanism.

1,159,093. Rheostat; T. Rhodus, Chicago, Ill. App. filed March 24, 1915. Includes an annular resistance element with wiper.

1,159,111. Incandescent Lamp; F. Skaupy, Berlin, Germany. App. filed Nov. 3, 1910. Halogen compound of thallium in hollow filament support.

1,159,121. Dynamo-Electric Machine; C. W. Starker, Pittsburgh, Pa. App. filed June 28, 1911. Laminated-core structure.

1,159,128. Electric Security Device; C. Stille, Friedenau, near Berlin, Germany. App. filed July 18, 1911. Includes a time switch.

1,159,154. Apparatus for the Electrolytic Manufacture of Alloys of Light Metals with Heavier Metals and the Continuous Treatment of Such Alloys for Obtaining Final Products; E. A. Ashcroft, London, England. App. filed March 12, 1912. Two electrolytic cells with a passage between.

1,159,174. Governing Mechanism for Mixed-Pressure Turbines; J. G. Callan, Boston, Mass. App. filed Sept. 28, 1912. Main and auxiliary regulating devices.

1,159,188. Intercommunicating Telephone System; G. Deakin, Oakland, Cal. App. filed Aug. 12, 1909. Busy trunk is guarded.

1,159,189. Vibrating Rectifier; J. T. Dempster, Schenectady, N. Y. App. filed June 3, 1912. Prevents reversal.

1,159,205. Protective Device; C. F. Frank, Schenectady, N. Y. App. filed May 15, 1914. Carborundum body.

1,159,207. Attachment-Plug Receptacle; G. A. Gauthier, Hartford, Conn. App. filed May 22, 1915. Shutters, plug apertures and flush plate.

1,159,209. Method of and Apparatus for Producing Electrical Impulses or Oscillations; R. H. Goddard, Worcester, Mass. App. filed Aug. 1, 1912. Wehnelt cathode.

1,159,224. Dynamo-Electric Machine; T. Hoock, Wilkinsburg, Pa. App. filed June 6, 1911. Special cooling features.

1,159,226. Transformer; S. E. Johannesen, Pittsfield, Mass. App. filed June 21, 1913. Flatiron strip, magnetic shunt.

1,159,228. Electrical Winding; E. Keidel, Berlin, and F. Sieber, Charlottenburg, Germany. App. filed Dec. 12, 1914. Zigzag type.

1,159,238. Brake; J. T. Leonard, Wichita, Kan. App. filed Jan. 29, 1913. Electrically operated friction brake.

1,159,294. Electric Safety Device; T. J. Tobin, Albany, N. Y. App. filed July 3, 1913. Makes "over-fusing" impossible.

1,159,307. Electrical Discharge Device; W. C. White, Schenectady, N. Y. App. filed March 20, 1914. Vacuum oscillator.

1,159,312. Electric Automobile Signal; F. A. Wright, Scranton, Pa. App. filed April 3, 1915. Rear-end signal.

1,159,335. Seal for Vacuum Apparatus; F. G. Keyes, Boston, Mass. App. filed March 6, 1913. Includes a barrier of yielding material.